



VILNIUS GEDIMINAS TECHNICAL UNIVERSITY

FACULTY OF BUSINESS MANAGEMENT

DEPARTMENT OF MANAGEMENT

Romanas Petrovskis

**RESEARCH ON IMPACT OF INVOLVEMENT OF ANSP IN DIFFERENT
PARTNERSHIPS ON ITS PERFORMANCE AND FURTHER
RECOMMENDATIONS FOR IMPROVEMENT OF CONCEPTUAL MODEL**

Master's degree Thesis

Engineering Economics and Management study programme, state code 621N20024

Aviation Management specialisation

Management study field

Vilnius, 2018

VILNIUS GEDIMINAS TECHNICAL UNIVERSITY
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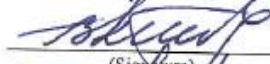
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OBJECTIVES FOR MASTER THESIS

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THE OBJECTIVES:

To analyse the theoretical aspects of partnerships and their impact on ANSPs performance, to create the set of the factors which allows to measure the partnerships impact on performance, to complete empirical investigation of conceptual model and to prepare recommendations for improvement of model under consideration.

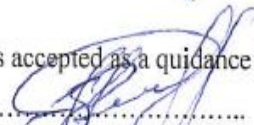
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Antrosios pakopos studijų Inžinerinės ekonomikos ir vadybos programos magistro baigiamasis darbas

Pavadinimas **Įtakos dalyvavimo įvairiuose partnerystės formose oro navigacijos paslaugų teikėjų veiklos rezultatams tyrimas bei tolimesnės rekomendacijos konceptualaus modelio tobulinimui**

Autorius **Romanas Petrovskis**

Vadovas **Živilė Tunčikienė**

Kalba: anglų

Anotacija

Baigiamajame magistro darbe nagrinėjamos oro navigacijos paslaugų teikėjų (toliau – ONPT) dalyvavimo įvairių partnerystės formose įtaka jų veiklos rezultatams. Išnagrinėtas ONPT teisinis reguliavimas, Europos Bendro dangaus reglamentų įtaką ONPT veiklai, reikalingumas steigti Funkcinius oro erdvės blokus, ONPT veiklos rezultatai, ONPT tinklaveika ir partnerystės modeliai, empiriniai tyrimai, nagrinėjantys partnerystės įtaką ONPT veiklos rezultatams. Pateiktas konceptualus ONPT dalyvavimo įvairiuose partnerystės formų įtakos ONPT veiklos rezultatams modelis (toliau – konceptualus modelis), kuris analizuojamas pasitelkiant kiekybinius metodus. Darbe įvertinama veiklos rezultatų priklausomybė nuo ONPT dalyvavimo įvairiuose partnerystės formose, pateikiamos rekomendacijos dėl konceptualaus modelio tobulinimo, išvados ir siūlymai ONPT dėl partnerystės plėtros.

Darbą sudaro 5 dalys: įvadas, teisinio reguliavimo ir ONPT dalyvavimo įvairiuose partnerystės formose analizė, ONPT dalyvavimo įvairiuose partnerystės formose įtakos jų veiklos rezultatams tyrimas, rekomendacijos dėl konceptualaus modelio tobulinimo, išvados ir siūlymai, literatūros sąrašas.

Darbo apimtis – 78 p. teksto be priedų, 42 iliustr., 8 lent., 42 bibliografiniai šaltiniai.

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Prasminiai žodžiai: oro transportas, oro navigacijos paslaugos, veiklos rezultatai, partnerystė

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Master Degree Studies **Engineering Economics and Management** study programme Master Final Thesis

Title **Research on Impact of Aviation Regulatory Institutions on Air Navigation Service Providers
Development and Following Management Decisions**

Author **Romanas Petrovskis**

Academic supervisor **Živilė Tunčikienė**

Thesis language: English

Annotation

The master thesis deals with the impact of participation by air navigation service providers (hereinafter - ANSPs) in various forms of partnerships on their performance. The ANSP legal framework, the impact of the Single European Sky Regulations on the ANSPs activities, the need for the establishment of Functional Airspace Blocks, the performance of the ANSPs, the ANSPs networking and partnership models, empirical studies examining the impact of the partnership on the performance of the ANSPs were analyzed. The conceptual model of impact of ANSP's involvement in partnerships on its performance (hereinafter referred to as the conceptual model) is presented, which is analyzed using quantitative methods. The thesis assess the dependence of the results on the participation of the ANSPs in the various forms of partnership, presents recommendations for improvement of the conceptual model, conclusions and suggestions to the ANSPs on the development of the partnership.

Structure: introduction, Legal background and models of participation of ANSP in different partnerships, research on impact of ANSPs' involvement in different partnerships on their performance, recommendations for modification of a conceptual model according to the empirical results, conclusions and further recommendations, list of references.

Thesis consist of: 78 p. text without annexes, 42 figures, 8 tables, 42 bibliographical entries.

Annexes included.

Keywords: air transport, air navigation services, performance, partnerships

(the document of Declaration of Authorship in the Final Degree Paper)

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**DECLARATION OF AUTHORSHIP
IN THE FINAL DEGREE PAPER**

May 28, 2018

I declare that my Final Degree Paper entitled „Research on Impact of Involvement of ANSP in Different Partnerships on its Performance and Further Recommendations for Improvement of Conceptual Model“ is entirely my own work. The title was confirmed on November 25, 2015 by Faculty Dean's order No. 203ai. I have clearly signalled the presence of quoted or paraphrased material and referenced all sources.

The academic supervisor of my Final Degree Paper is Živilė Tuncikienė.

No contribution of any other person was obtained, nor did I buy my Final Degree Paper.



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SANTRAUKA

Civilinės aviacijos sektoriaus plėtra sukuria bei sudaro prielaidas kurti naujas darbo vietas, skatina turizmą, generuoja naujus tiekėjų / teikėjų tinklus, mažina pasaulinės prekybos kaštus ir atveria naujas kitomis transporto priemonėmis sunkiai pasiekiamas rinkas, o tai savo ruožtu skatina spartesnę ir tvaresnę skirtingų pasaulio regionų augimą. Šio sektoriaus infrastruktūros sudėtinė, neatskiriama dalis yra oro navigacijos paslaugų teikėjai (toliau – ONPT). Jų veiklos rezultatams vis didesnę įtaką turi įvairios šios srityje egzistuojančios ir naujos bendradarbiavimo / partnerystės formos. Oro navigacijos paslaugų teikėjai ieško sprendimų ir priemonių patenkinti paslaugų vartotojų, t.y. oro erdvės naudotojų lūkesčius, siekia atitikti esamus ir naujai kuriamus reikalavimus, tokiu būdu prisitaikant prie besikeičiančios aplinkos, pasinaudojant atsiveriančiomis galimybėmis plėtoti bendradarbiavimą bei kurti / teikti naujas paslaugas. Darbe analizuojama Europos ONPT veiklos rezultatus lemiantys veiksniai ir įvairių bendradarbiavimo / partnerystės formų įtaka jų veiklos rezultatams. Darbe taip pat pateikiami pasiūlymai dėl šių bendradarbiavimo / partnerystės formų konceptualaus modelio pagerinimo.

ABSTRACT

Development of civil aviation sector supports the employment, stimulate the tourism, generates new supplier chains, reduces the cost of global trade and open up new markets, which could be difficult to achieve by other means of transport, which in turn triggers faster and more sustainable growth in this regions the world. Air navigation service providers (ANSPs) are an integral and inseparable part of the aviation sector. A growing influence to their performance and the development has an involvement in variety of partnership forms. ANSPs looking for solutions and means to meet airspace users' expectations, aims to meet newly emerging applicable requirements, trying to adapt to a changing environment and to take advantage of the opportunities to expand cooperation and create / provide new types of services. This work analyses impact of involvement in various partnerships, on European ANSPs' performance results. Provided conclusions and further recommendations for conceptual ANSPs partnership model enhancement.

ABBREVIATIONS

ACE	ATM Cost Effectiveness
ANS	Air Navigation Services
ANSP	Air navigation service provider
ASECNA	Agency for Aerial Navigation Safety in Africa and Madagascar
ASM	Air Traffic Management
ATCO	Air Traffic Control Officer
ATFCM	Air Traffic Flow and Capacity Management
ATFM	Air Traffic Flow Management
ATM MP L3	ATM Master Plan Level 3
ATM MP	European Air Traffic Management Master Plan
ATM	Air Traffic Management
CAA	Civil Aviation Administration
CNS	Communication, navigation and surveillance
COCESNA	Corporación Centroamericana de Servicios de Navegación Aérea
CS	Centralised Services
EASA	European Aviation Safety Agency
EC	European Commission
ESSIP	European Single Sky ImPlementation Plan
EU	European Union
EUROCAE	European Civil Aviation Conference
EUROCONTROL	European Organisation for the Safety of Air Navigation
FAB	Functional Airspace Block
IATA	International Air Transport Association
ICAO	International Civil Aviation Organisation
IFATCA	International Federation of Air Traffic Controllers
IFR	Instrument Flight Rules
KPA	Key Performance Areas
KPI	Key Performance Indicators
LSSIP	Local Single Sky ImPlementation Plan
PCP	Pilot Common Projects

PPP	Private Public Partnership
PRB	Performance Review Body
PRU	Performance Review Unit
RP1	First reference period (2012-2014)
RP2	Second reference period (2015-2019)
SES	Single European Sky

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INTRODUCTION

Relevance of the topic. Today air transport industry plays a major role in driving sustainable economic and social development. 2013–2028 Global Air Navigation Plan produced by International Civil Aviation Organisation (ICAO) states, that it directly and indirectly supports the employment of 56.6 million people, contributes over \$2.2 trillion to global Gross Domestic Product (GDP), and carries over 2.9 billion passengers and \$5.3 trillion worth of cargo annually.

Aviation achieves its impressive level of macroeconomic performance by serving communities and regions through clear cycles of investment and opportunity. Infrastructure development generates initial employment and the ensuing airport and airline operations generate new supplier networks, tourism influxes and access for local producers to distant markets. These burgeoning trade and tourism economies then continue to expand, fostering wider and more sustainable regional growth. That means air transport sector has an impact on world economy progress, however by itself dependant on economy development (ICAO doc 9750).

Most important element of aviation sector is an air transport and its infrastructure. Above mentioned elements consist of: aerodromes and operators of airports, ground handling companies, aircraft producers, ground components of aeronautical equipment producers, aircraft and ground aeronautical equipment maintenance organisations, air navigation service providers, ticket offices, cargo terminals and distribution companies, aviation medicine centres, etc. In the last decades key role in aviation sector development, strategic planning, deployment and its performance goals establishment has research organisations. Sustainable activities of above-mentioned organisations depend on the proper implementation of the established requirements / standards and on the ongoing cooperation and harmonization of the interactions (Regulation (EU) No. 549/2004; Ellis Juan and Doug Andrew, 2006; UAB “Ekonominės konsultacijos ir tyrimai”, Vilnius, 2005).

ANSPs and their infrastructure are critical elements and links to the air transport system, connecting different regions and making Europe a world mover and prosperity center. In order to ensure the sustainability and competitiveness of aviation development, a clear vision of the aviation community is needed, how to maintain and continually improve the level of performance of the air traffic management system (Mark Smyth, Brian Pearce, IATA, 2007; Daniel Calleja Crespo, Pablo Mendes de Leon, Kluwer Law International, 2011).

The idea of the research is to assess the impact of different partnerships on ANSPs performance and provide recommendations for improvement of model.

Level of examination of relevant issues. Researches and first monitoring activities on performance of ANS services starts by ICAO in early 90's. In more deep and consistent manner performance of ANS examined in Europe since beginning of implementation of Single European Sky

(SES) initiative. Performance improvements are the corner stone of SES and tightly connected with establishment of new partnership form – Functional Airspace Blocks. (FABs). Since beginning of SES implementation regular ANS performance review is conducted by European Commission nominated bodies on ANSP level, and, after establishment of FABs, on ANSP and FAB level. Researches (K. Button, R. Neiva, P. R. Mark, C. A. Nava-Gaxiola, C. Barrado and others) have investigated this issue, but this topic is still very relevant at EU level and worldwide.

Problem. Under the 1944 Chicago Convention, governments have sovereignty over their national airspace, and thus each country has traditionally dealt with this issue by having its own air ANSP that handles ANS and other related matters such as weather information services and flight planning. This has continually posed challenges of ensuring both the internal efficiency of individual monopoly suppliers of ANS and the external efficiency of ensuring optimal coordination of service between a series of network suppliers (IATA, 2007).

Despite of some success, the first SES package (SES-I) did not create the expected level of required changes to significantly improve the performance of the ATM in Europe. Therefore, second SES package (SES-II) refers to further improvement of the efficiency of air traffic management (ATM) system in Europe imposing creation of the FABs by the end of 2012 and motivating EU ANSPs for various cooperation forms.

Object. Object of the research is different forms of partnership of ANSPs.

Aim of the research. The aim of the research is to modify a conceptual model of impact of partnerships on ANSP performance based on the empirical results.

In order to achieve the aim the following tasks are formulated:

1. To provide argumentation for necessity of ANSPs involvement in different partnerships
2. To provide the legal background for the ANSPs involvement in different partnerships
3. To review models of participation of ANSP in different partnerships
4. To develop a conceptual model of impact of partnership on ANSP performance
5. To assess the impact of involvement of ANSP in different partnerships on its performance
6. To provide conclusions and further recommendations for modification of a conceptual model of impact of partnership on ANSP performance.

Author's theoretical contribution and practical applicability. Scientific novelty of the master thesis lies in the following: analysis of models of participation of ANSP in different partnerships resulting a comprehensive list of different models and forms of ANSP' partnerships, a conceptual model of impact of partnership on ANSP performance, cross-country results on the impact of involvement of ANSP in different partnerships on its performance development. The empirical results of the master thesis could be useful for ANSP's managers responsible for strategic development of their organizations.

Methods. The following research methods were used in this paper: the systemic, logical and comparative analysis of scientific literature, analysis and interpretation of the statistical data, synthesis, correlation analysis and panel regression analysis.

Literature review. Trends in ANS liberalisation at European and worldwide level suggest about performance based approach and introduction of incentive schemes, or even competition. For this reason, it is very important for ANSPs to look for the different partnerships with aim to enhance their services of to diversify their activities and income sources. Some of the ANSPs are looking for partnership with aim to have a stronger political voice and influence in their region.

Introduced by SES initiative and its regulatory packages FAB initiatives show wide differences in scope, timescales and approaches. FABs were widely seen by stakeholders to have generated high administrative costs those are not fully offset by the operational and performance benefits. As a consequence of the lack of ambition to implement FABs and the absence of formalised shared accountability for FAB performance. It is clear that a flexibility of approach needs to be maintained, as long as improvements are delivered.” (Eurocontrol, 2008, Integra 2017).

The efficiency of ANSPs within Europe is really very relevant topic. In recent years the average costs of ANS in Europe has tended to fall due to the economic recessions, the eurozone crisis and, in particular, due to regulatory impact imposed by Performance regulation (EU 390/2013), but the forecasts shows positive performance trends at least for 7 years period (Button, Kenneth; Neiva Rui, 2013). FABs and some other partnerships are used as an umbrella for some states to undertake projects together, have a stronger political voice, but it is not seen to have an economic or financial dimension (Integra, 2017). Industrial partnership is quite new for ANSPs and its impact on their performance should be analysed further.

Structure. The structure of the master thesis is the following. First chapter provides legal background and models of participation of ANSP in different partnerships, necessity of ANSPs involvement in different partnerships, regulatory framework for ANSPs involvement in partnerships and models of participation of ANSP in different partnerships, review of empirical studies investigating the impact of ANSP involvement in partnerships on its performance, development of a conceptual model of impact of ANSP's involvement in partnerships on its performance, and methodology of research on impact of involvement of ANSP in different partnerships on its performance. Second chapter provides research results on impact of ANSPs' involvement in different partnerships on their performance, including networking analysis of ANSPs' involvement in different partnerships, analysis of FABs' and ANSPs' performance in Europe, research results on impact of involvement of ANSP in different partnerships on its performance. Finally, recommendations for modification of a conceptual model according to the empirical results and conclusions and further recommendations are provided in the last two chapters of the master thesis.

1. LEGAL BACKGROUND AND MODELS OF PARTICIPATION OF ANSP IN DIFFERENT PARTNERSHIPS

1.1. NECESSITY OF ANSPS INVOLVEMENT IN DIFFERENT PARTNERSHIPS

Having in mind a European and worldwide trend for ANS liberalisation, performance based approach and introduction of incentive schemes, or even competition, it is vital for ANSPs to look for the different partnerships with aim to enhance their services and to diversify their activities and income sources. Some of the ANSPs are looking for partnership with aim to have a stronger political voice and influence in their region. (E. Juan and D. Andrew, 2006; M. Smyth, B. Pearce, IATA, 2007).

The main reason for participation of ANSPs in different forms of partnership is a large number of ANSPs operating in Europe and fragmentation of European air navigation services industry. Unlike the US, which has just a single ANSP (the Federal Aviation Administration (FAA)), Europe has several dozen ANSPs to handle an approximately area similar geographical area. Albeit similar in size, the European system handles fewer flights, using more centers and airports and is more labour intensive than the American system (see Table 1).

Table 1. Comparison of US and European Air Navigation Systems

Indicators	Europe	US	Difference: US vs. Europe
Area (million km ²)	11.5	10.4	-10%
Number of air service navigation providers	37	1	
Number of air traffic controllers	17,2	13,3	-23%
Total staff	58	35.500	-39%
Controlled flights (million)	9.5	15.2	59%
Share of flights to/from top 34 airports	67%	66%	-
Share of general air traffic	3.9%	21%	x 5.4
Flight hours controlled (million)	14.2	22.4	59%
Relative density (flight hours per km ²)	1.2	2.2	x 1.8
Average length of flight (within respective airspace)	559NM	511NM	-11%
Number of en-route centers	63	20	-42
Number of approach control units (Europe) and terminal facilities (US)	260	162	-98
Number slot controlled airports	>90	4	
ATM provision costs (billions of €2011)	8.4	7.8	-12%
Area (million km ²)	11.5	10.4	-10%

Note: NM is nautical miles

Source: Eurocontrol Performance Review Commission & US Federal Aviation Administration (2013)

There are a number of technical reasons that can explain the differences, including geography, but a particular issue is that lack of coordination across the European systems, and that the small scale of many of the national European ANSPs prevents economies of scale from being exploited. This

fragmentation of the airspace, with its boundaries mimicking the national borders on land and frequent handing over of traffic, is believed to have significant impacts on the overall performance of the system. This resulted in an estimated €4.0 billion in annual delay costs in 2011, significant environmental damage, and flights that are, on average, 49 km longer than they would need to be if the airspace was optimized and more modern technologies were utilized (Eurocontrol Performance Review Commission, 2011; Button and Neiva, 2013; 2014). For that the European Commission created the above mentioned SES initiative with the aim of treating European air space as a single entity, instead of being a patch work of all the different national systems. Because of the complexity of the systems, their diversity, and the inability to simply carry through a “big bang” style reorganization, a phased approach to reform was initiated (European Commission, 2015; K. Button&R. Neiva, 2013; M. Baumgartner&M. Finger, 2014).

Analysis of European ANSPs market shows fragmentation of the European airspace into 37 national air traffic control systems. This hampers a safe and cost efficient service provision and means has impact on their performance:

- Mostly each service provider functions (exclusion Maastricht upper airspace control centre) in its legal and institutional environment with national airspace rules and operating procedures. This leads to diverging performances in terms of safety, capacity and cost-efficiency.
- Even the largest EU Member States turn out to be global dwarfs in terms of size of controlled airspace. In addition, the size of air traffic centers, which they are operating, appears to be suboptimal, with a multiplicity of technical systems and high maintenance costs. The cost of fragmentation amounts to as much as one billion euros. The relative lack of fragmentation is one major element helping to make the US air traffic management system twice as efficient as that of the EU.
- Air traffic control is provided from some 50 en-route units or air traffic control centers, and hundreds of approach centers and towers. Airspace is divided into more than 650 sectors. Each change of sector obliges the pilot to change frequency and to contact the next air traffic controller. Functionality of sector design is limited to national borders. Transfers of flights between centers are regulated through an extensive exchange of letters of agreement.
- Flexibility in sector management is limited to the center level. Each sector needs to be permanently manned by a team of air traffic controllers, who require some two to four years to become fully operational on a reasonable number of sectors. This results in relatively low productivity rates with air traffic control productivity ranging between 0.1 and 1.6 flight hours per air traffic control hour.
- Safety levels between service providers vary significantly. Only one third of Member States is currently in a position to provide satisfactory incident reports, which form the basis of any safety management policy.

- The small scale of operation is also an obstacle to the swift introduction of new technologies. As air traffic management is a niche market in global terms, equipment manufacturers have few incentives to develop new technologies. Service providers historically showed little interest in interoperability and preferred tailor made systems instead of increasing commonality by adapting off the shelf solutions to air traffic management needs (European Commission, 2015). Despite on-going industrial partnership initiatives such as COOPANS, iTEC and 4Flight level of lack of interoperability of systems and its fragmentation still high.

ATM in Europe still has a number of shortcomings. In spite of much effort to modernise and streamline it, Europe's air traffic management system remains safe but costly. The following challenges were outlined by European Commission in 2015:

- ANSPs fragmentation - still exists e.g. at ATC level and in the technical infrastructure. Much of the technology used is outdated. In addition, ANS is still provided within national boundaries. This fragmentation is the main problem that affects the safety, limitation of capacity and increases overall cost of flight and moreover it slows down the decision making process necessary to introduce new technology and to tailor services to customer needs;

- High ANS unit cost still too high/expensive. The entire system of ANS provision is financed through charges paid by airspace users. In 2013, total ANS costs were around €9 047M, of which some €7 937M related directly to the provision of gate-to-gate ATM/CNS. The air navigation services costs represent roughly 6 % of the total operating costs of airlines;

- Monopoly, lack of competition, weak oversight of the ANS market remains exceptional and voluntary at a nation's discretion. ANSPs remain monopolies, so there are few incentives for efficiency or regulation. The monopoly service provision and the absence of competition require a strong economic regulation;

- Lack of flexibility of human resources - intensive industry that in total employ 57,500 staff. Some 17 500 staff (30%) were ATCOs working on operational duty. On average, 2.3 additional staff are required for every ATCO in OPS in Europe. Staff costs make up 63% of total costs to an ANSP where ATCOs take half of that percentage. The cost-efficiency to technical, operational and administrative support could be much higher if service provision and infrastructure were rationalised.

- By the Commission, during the execution - FABs have not delivered the expected performance gains so far for the SES. Other potential areas for development for ANSPs in the SES2+ proposal include promoting industrial partnerships to achieve these performance gains.

ANS providers mostly operate as natural monopolies (excluding those which provide ANS services in particular airport which not under control of large ANSPs), which raises issues of autonomy, effective management and control. However, it is understood, that senior management need to have direct responsibility and some discretionary decision 'space' over the services they

provide, it is unclear how much authority has actually been devolved, and how managerial action has been controlled to achieve the executive government's objectives.

Current situation analysis shows that now over 40 national governments have implemented modernisation reforms in their Air Navigation Services (ANS). Modernisation's preoccupation with structural change has seen the provision of ANS increasingly move from public sector departmental organisations to autonomous entities whose organisational forms now include performance-based agencies, Government Business Enterprises and Corporations, Public-Private Partnerships (PPP), and private not-for-profit models (A Jones, J. Guthrie, Rotterdam 2008).

1.2. REGULATORY FRAMEWORK FOR ANSPS INVOLVEMENT IN PARTNERSHIPS AND MODELS OF PARTICIPATION OF ANSP IN DIFFERENT PARTNERSHIPS

1.2.1. THE SINGLE EUROPEAN SKY AND ESTABLISHMENT OF FABS'

Air navigation services in Europe are undergoing the process of consolidation (administrative measures) and technological changes known as the Single European Sky (SES) initiative. The Single European Sky (SES) is a European Commission initiative designed to remove boundaries in the air. Administrative measures include creation of Functional Airspace Blocks, Network management function and other actions. Technological changes - technological pillar of SES is SESAR project¹. The SES main goal is to reform the architecture of the European air traffic control to meet future capacity and safety needs. This will be achieved by improving the overall performance of Air Traffic Management (ATM) and Air Navigation Service (ANS) in Europe, with the aim to (N. Hartman, M. Boscoianu, 2015) (see Figure 1). The below mentioned objectives are named as SES High Level Goals.

To implement the initiative and SES High Level Goals European Parliament and Council on 10 March 2004 issuing 4 Framework regulations (also known as SES-I):

- No 549/2004: Framework regulation – laying down the framework for the creation of the Single European Sky;
- No 550/2004: Service Provision regulation – on the provision of air navigation services for the Single European Sky (Common requirements for the provision of air navigation services, requirements for certification of ANSPs and principles for imposing air navigation fees on airspace users);

¹ SESAR project – it's a Single European Sky new ATM system Research. The SESAR project aims to integrate and coordinate research and development activities which were previously undertaken in a dispersed and uncoordinated manner in the Community, including the most remote and outlying regions thereof, referred to in Article 299(2) of the Treaty (Regulation 549/2004; Regulation 219/2007).

- No 551/2004: Airspace regulation – on the organization and use of the airspace in the Single European Sky (Reducing of fragmentation - Functional Airspace Blocks (FABs) should not be based on national boundaries but on the optimization of the traffic flow),
- No 552/2004: Interoperability – on the interoperability of the European Air Traffic Management network.

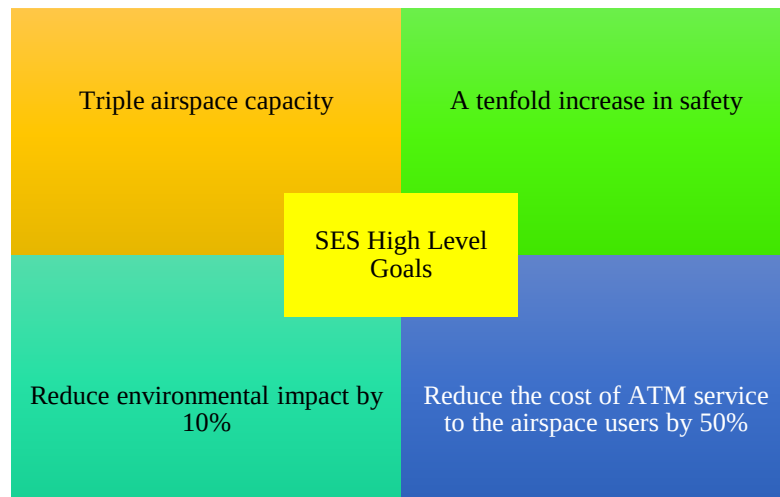


Figure 1. SES High Level Goals

Source: compiled by author based on Regulation (EC) 1079/2009

The main aim of the first SES (SES-I) legislative package was:

- To improve standards of safety and efficiency of aviation sector in Europe;
- To reduce to the minimum air traffic delays by increasing airspace capacity;
- To improve the air navigation services and minimize the cost of their provision by reducing the fragmentation of the ATM/ ANS in Europe;
- To cooperate with military authorities and to incorporate to maximum possible extent their ATM/CNS systems into the European ATM system;
- To meet the requirements and expectations of all categories of airspace users.

In spite of some success, the first package did not create the expected level of required changes in order to significantly improve the performance of the ATM in Europe. Therefore, in June 2008 the revision of the SES regulations was adopted under the name of Single European Sky second package (SES-II). In March 2009, Eurocontrol endorsed the second Single European Sky package by EU Transport Ministers, following its adoption by the European Parliament. The legal footing was Regulation (EC) No 1070/2009, which amended Regulations (EC) No 549/2004, (EC) No 550/2004, (EC) No 551/2004 and (EC) No 552/2004, and it refers to further improvements of the efficiency of air traffic management system in Europe. The main aim of this package was:

- To ensure the effectiveness of air navigation services and to implement the Network Management function (Eurocontrol);
- To establish a single legal framework in order to facilitate the development of a harmonized safety regulations and their effective implementation (establishment and delegation of functions to EASA);
- To implement new technologies to facilitate the use of new operational concepts, and increase the safety of flights and reduce their negative environmental effect;
- To improve the management of the airports capacity.

The overriding objective of SES-II is to increase the economic, financial and environmental performance of the provisions of the Air Navigation Services in Europe. SES-II performance contribution to the overall SES framework shown in Annex 1. Implemented amendments are based on four pillars (N. Hartman, M. Boscoianu, 2015; M. Baumgartner, M. Finger, 2014):



Figure 2. Four pillars of SES-II

Source: compiled by author based on Regulation (EC) 1079/2009

At the moment SES initiative, consist of more than 50 European Union and European Commission regulations, Directives, specifications and specific guidance materials (see Annex 2). Over the years, SES has developed into a performance-oriented system in which the service providers (or ANSPs) are incentivised to adopt new administrative changes (as well as new ways of managing the business), concepts of operations and technologies to achieve the SES High Level Goals (P. Ravenhill, T. Bolic, EC, 2017).

It is against this background that the European Commission created the above-mentioned SES initiative with the aim of treating European air space as a single entity, instead of being a patchwork of all the different national systems. Because of the complexity of the systems, their diversity, and the inability to simply carry thorough a “big bang” style reorganization, a phased approach to reform was initiated. A major transitional component of this program is the establishment of FABs, which are intended to aggregate several individual ANSPs into larger entities that would handle air traffic as if they were a single ANSP. Strictly, a FAB is defined in the SES-II legislative package, namely Regulation (EC) No. 1070/2009 amending Regulation (EC) No. 549/2004, as 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 optimized through enhanced

cooperation among air navigation service providers or, when appropriate, an integrated provider. The ultimate aim of these administrative changes is to shift the service provision from a paradigm based on national borders, to one where performance is the goal (European Commission, 2015; Kenneth Button, Rui Neiva, 2013; M. Baumgartner, M. Finger, 2014).

The origin of the FAB concept development across Europe started with the Maastricht Upper Area Control Centre (MUAC)². Consequently, this airspace has proven the FAB concept by showing the advantages of this kind of international cooperation. Model originally introduced by Wilmer et al. (2001) of bottom-up regional cooperation has been proposed to ANSPs of the EU in 2004, to establish the regulatory framework for FABs of their upper air spaces. These FABs would be designed on the bases of uniform operational requirements and be free from the constraints of national borders. A more integrated airspace will mean less fragmentation, less delays, and lower costs of providing essential services to aircraft. According to Figure 3, these jointures would also fulfil the expectations laid out in ICAO's Global Air Navigation Plan (ICAO, doc 9750) for optimal efficiency, which encompassed features of seamless interoperability, increased capacity, safety performance and environmental friendliness (Mark, 2014).

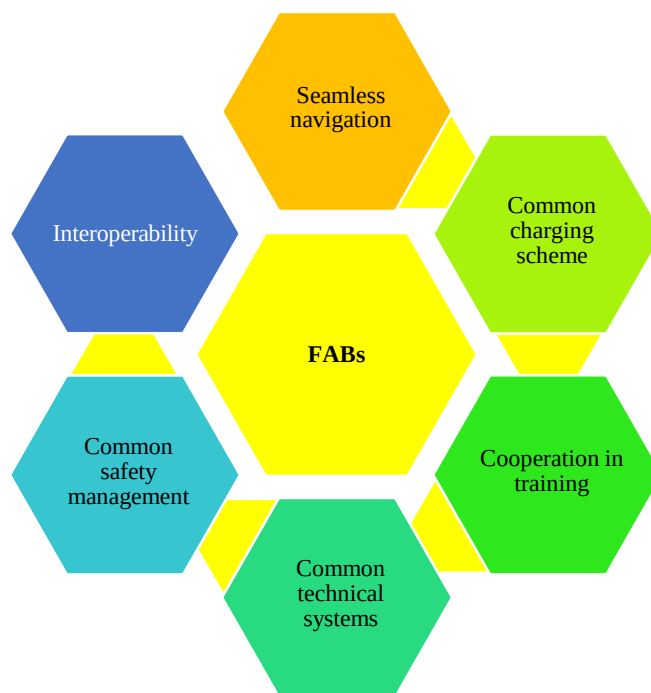


Figure 3. The FAB Approach – a common framework

Source: Mark (2014)

² MUAC provides air traffic control for the upper airspace (flight level above 24,500 ft or FL245) of Belgium, the Netherlands, Luxembourg and the North-West of Germany.

Nowadays FABs is the main tool for reducing the European airspace fragmentation, but also should have its positive impact, as it was stated in SES-II package regulations, to safety and effectiveness of service provision, performance planning and monitoring.

Regulation (EC) No. 1070/2009 amending Regulation (EC) No. 549/2004 Article 11 states, that with aim to improve the performance of air navigation services and network functions in the single European sky, a performance scheme for air navigation services and network functions shall be set up. It shall include:

- Community-wide performance targets on the key performance areas of safety, the environment, capacity and cost-efficiency;
- National plans or plans for functional airspace blocks, including performance targets, ensuring consistency with the Community wide performance targets; and
- Periodic review, monitoring and benchmarking of the performance of air navigation services and network functions.

It means that states and their ANSPs, individually or cooperating in FABs and Network function representative should work together on the improvement of overall ANS performance. Performance monitored in defined Key performance areas (KPA), establishing for the specific Key Performance indicators (KPI). Selection of appropriate key performance areas is based on ICAO Document No 9854 ‘Global air traffic management operational concept’, and consistent with those identified in the Performance Framework of the ATM Master Plan, including safety, the environment, capacity and cost-efficiency areas, adapted where necessary in order to take into account the specific needs of the single European sky and relevant objectives for these areas and definition of a limited set of key performance indicators for measuring performance (Regulation 1079/2009).

In addition to the regulatory framework, an empirical study shows how the SES has many stakeholders (airliners, ANSPs, industries, government agencies, etc.) with different objectives, some of them divergent and arguments that the main stakeholder with clear goals and potential benefits in FAB implementation are the commercial airlines, but not ANSPs (M. Baumgartner, M. Finger, 2014). Another study of the European FABs concludes that the fragmented air traffic management in Europe impacts on safety, limits airspace capacity, and above all, adds costs to the system, that means initially to ANSPs and airspace users (airlines), and finally to the ticket or simply tax payer (K. Button, R. Neiva, 2013; C. A. Nava-Gaxiola, C. Barrado, 2016).

Starting as from 2011 ANSPs performance where monitored. During this time two regulations Commission regulation (EU) No 691/2010 of 29 July 2010 and Commission Implementing Regulation (EU) No 390/2013 of 3 May 2013 laying down a performance scheme for air navigation services and network functions where issued. According to first one performance where monitored individually (RP1), starting from second one, having in mind that according amended Framework

regulation FAB should be established by 4 December 2012. 9 Functional Airspace Blocks were declared by the European Commission as shown in Figure 4, performance planned and monitored on FAB level (RP2). Data analytics determined that the hybridization of Europe's upper airspace would counteract the growing problem of inefficient ANS. It means that creation of the FAB should bring tangible performance benefits.

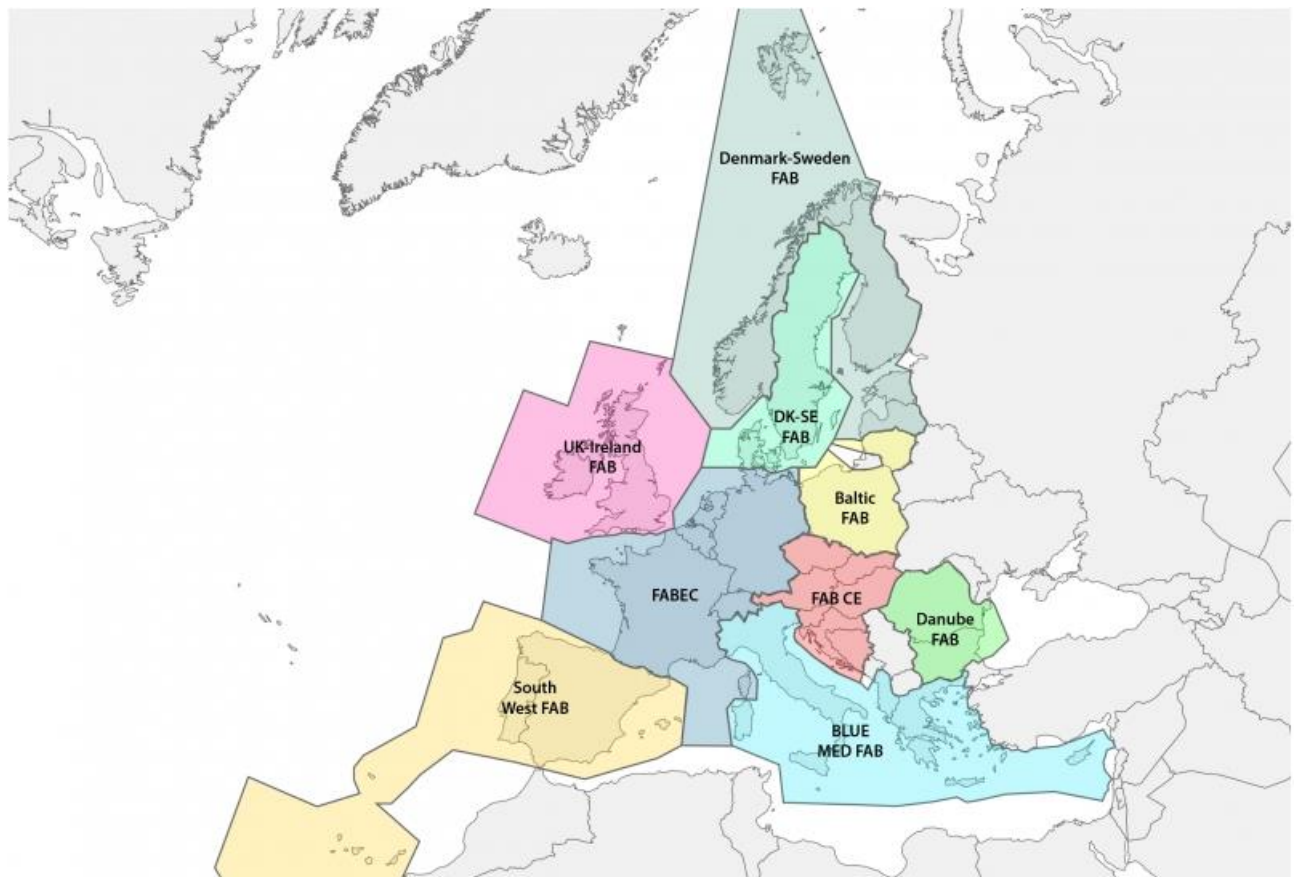


Figure 4. Map of FABs in Europe

Source: Mark (2014)

It should be recognized, that not only ANSPs are participating in FABs. FAB agreements concluded on the States level, should be approved by Parliament and after signed by President. In FAB activities execution should participate all levels of governance of aviation sector starting from ministries and ending up with ANSPs. Effective establishment and further management and activities execution is based on well-established cooperation and activities coordination between all participating organisations inside the State and on appropriate implementation and management levels (Table 2). Additional agreements on partnership / cooperation fostering the process, establish clear responsibilities and accountabilities between parties involved. It should be mentioned, that establishment and recognition of FAB is long, structured and much documented process in which all interested stakeholders apart State entities taking part (EC, EASA, IATA and airspace users, trade

unions). Table 2 shows only levels of management and implementation inside FAB on different State levels.

Table 2. Levels of FAB implementation and management

	FAB		
	State 1	State 2	State X
Level of approval	President (or higher level of governance in state)	President (or higher level of governance in state)	President (or higher level of governance in state)
	Parliament	Parliament	Parliament
Level of management, policy implementation and overall oversight	Ministry of Transport / Ministry of Defence / etc.	Ministry of Transport / Ministry of Defence / etc.	Ministry of Transport / Ministry of Defence / etc.
Implementation level	Military Authorities (Air force Headquarter, Flight Safety Department, etc.)	Military Authorities (Air force Headquarter, Flight Safety Department, etc.)	Military Authorities (Air force Headquarter, Flight Safety Department, etc.)
	CAA ANSPs (ATM, AIS, CNS and MET)	CAA ANSPs (ATM, AIS, CNS and MET)	CAA ANSPs (ATM, AIS, CNS and MET)

Source: compiled by author based on EC Guidance Material for the Establishment & Modification of FAB

However, researchers, international organisations, airlines and other aviation sector stakeholders assess the performance benefits of SES and, in particular, FAB implementation initiative differently. In “Blueprint for a Single European Sky”, IATA identified the main benefit of implementation of Single European Sky concept in the following areas (see Figure 5).

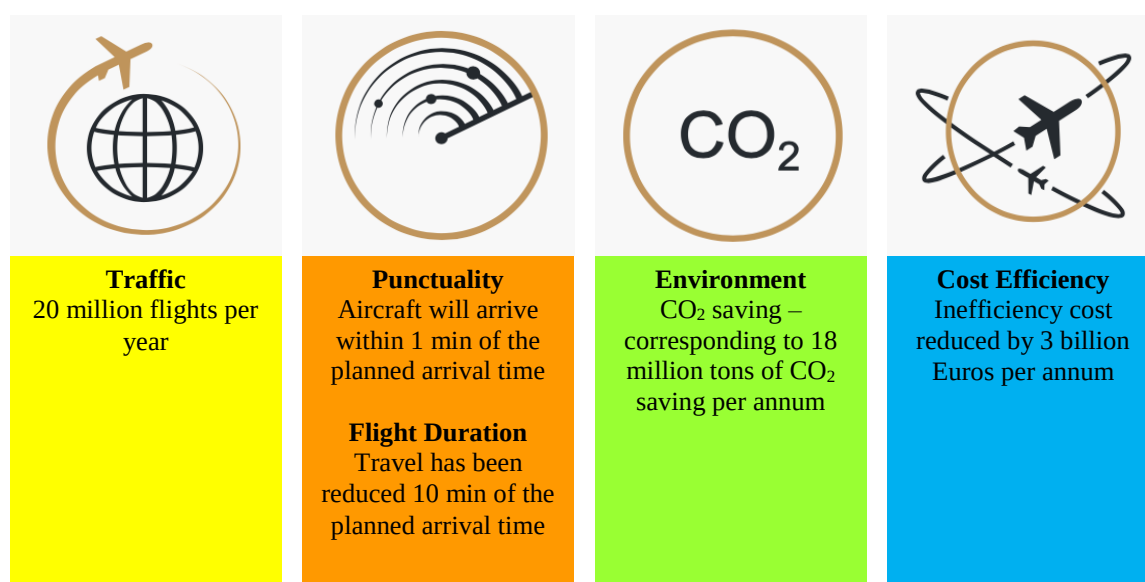


Figure 5. The main benefit of implementation of SES concept

Source: IATA

All those benefits have positive effect for airline industry, but most important part for them cost savings. Those savings could be achieved through – optimal flight trajectories, reduced

operational cost per service unit, optimal and performance based investments of ANSPs (N. Hartman, M. Boscoianu, 2015).

Other stakeholders of aviation industry (Ministries, Trade unions, National Supervisory Authorities, ANSPs, etc.) assessing FABs activities, recognised that FABs widely seen to have generated high administrative costs that are not fully offset by the operational and performance benefits, as a consequence of the lack of ambition to implement FABs and the absence of formalised shared accountability for FAB performance. In addition, the synergies from FABs are not presented in explanations of how accountable entities will reach their performance targets. Moreover, the potential benefits of FABs do not appear to be factored into the capacity and cost efficiency targets submitted by FABs and States. Stakeholders highlighted that a more performance and market-based approach would be needed to drive change (Integra, 2017).

FABs are seen as an explicit bottom-up approach to the ultimate integration of European airspace. They seek to improve ANS for a number of agency airspaces by introducing better coordination of their ANSPs. The underlying philosophy being that, “each FAB is different and faces different political, operational, technical, and economic challenges. FAB initiatives show wide differences in scope, timescales and approaches. It is clear that a flexibility of approach needs to be maintained, as long as improvements are delivered.” (Eurocontrol, PerformanceReview Commission, 2008; Button, Kenneth; Neiva Rui, 2013).

However, statement that creation of FABs is bottom-up approach, not purely true, because of mandatory issue of requirement to establish FAB shows it top-down nature (Regulation 549/2004). C. Menard (2011) and P. R. Mark (2013) see FABs as hybrids, which cannot be identified as strategic alliance or joint venture, but it is a combination of it. Hybrids can be defined as arrangements in which two or more partners pool strategic decision rights as well as some property rights, while simultaneously keeping distinct ownership over key assets, so that they require specific devices to coordinate their joint activities and arbitrate the allocation of payoffs. P. Hazlewood (2015) describes above-mentioned types of partnerships as multi-stakeholder partnerships (MSPs), including Joint Project, Joint Program, Strategic Alliance and Collective impact (see Figure 6).

In addition to P. Hazelwood, J. W. Selsky and B. Parker (2005) define one of the branch of MSPs as cross-sector partnerships, which includes two or more actors from government, business (and/or other private sector actors), public sector, civil society, and/or other multilateral agencies. It was acknowledged, that concepts of FABs holding important positive roles in the optimization of the performance of ANSPs. These airspace blocks are hybridized upper en-route, and in some cases lower air spaces of the European Union (EU). However, economic hybridization brings the side effect of censoring factors, which detract from the efficiency of the process. FABs display a two-fold activity;

on the one hand, these hybrid airspaces offer increased optimization of air traffic management. On the other, they also augment the latency effect of heterogeneity.

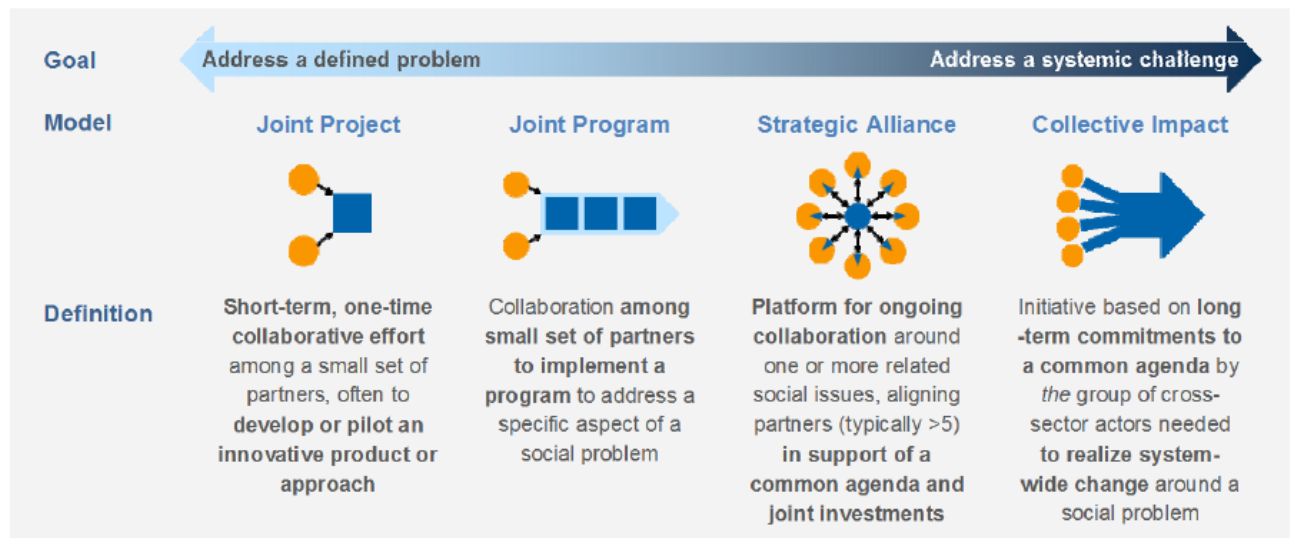


Figure 6. A basic typology of multi-stakeholder partnerships

Source: Hazelwood (2015)

FABs are one of the fundamental pillars of the SES initiative, which have the goal of reducing the inefficiencies in terms of safety, capacity, and cost efficiency rising from the fragmentation of European airspace. FABs are multi-state arrangements imposed by SES Framework regulation, aimed to reduce the fragmentation of the European ATM network and thus to improve performance. However, FABs should be based on a “bottom-up” approach and partnerships. A “top-down” approach forcing ANSPs to achieve reorganisation of airspace cannot be successful when entities find themselves to some extent in competition. In conclusion, the FABs are one of the most complex cases of cross-sector partnership due to a larger number of different level of actors with contradictory interests. In future, FABs seem to be superseded by another forms of partnership (e.g. industrial partnerships), particularly, the smaller FABs.

1.2.2. MODELS OF PARTICIPATION OF ANSP IN DIFFERENT PARTNERSHIPS

The substantial interest in cooperation or partnership is based on the assumption that collaboration enhances the capacity of organisations to achieve their goals. Collaboration defined as “a process through which parties, which see different aspects of a problem can explore constructively their differences and search for solutions that go beyond their own limited vision of what is possible”. Lasker et al. (2001) have described collaboration as a process that enables independent individuals and organisations to combine their human and material resources so they can accomplish objectives

they are unable to bring out alone (R.D. Lasker, E.S. Weiss, R. Miller, 2001). J. Rees, D. Mullins and T. Bovaird (2012) state that partnerships create certain opportunities – or even a form of synergy – in sharing assets, the ability to fundraise, and finally the ability to share knowledge across the group.

The SES regulatory framework opened new opportunities to ANSPs. The opening market for competition in air navigation services industry has already taken place in some Member States based on purely national initiatives (UK, DE) and is expected to expand over time. Given the trends of changes in air transport services industry as well as opening of ATM/ANS services for competition, ANSPs will be forced to apply new business models, developing non-core business and participating in international cooperation and industrial partnerships with the focus on innovation and commercialization issues.

Despite the fact that no two ANSPs are precisely alike, from service perspective the air navigation services are almost interchangeable. ANSP operates as a “connector and consolidator of information” with almost no unique selling proposition compared to other ANSPs. In general, ANSP should be vulnerable to new entrants in their markets if not protected by political barriers or by providing something that differentiates them from the rest. In case of market liberalization, ANSPs will face difficulties in differentiating themselves from each other, which is likely to result in a reduction of ANSPs.

The first stage of commercialization of ANS is the transition from state-owned to private-owned (or partially private-owned) ANSP (e.g. NATS, DFS, ENAIRE, etc.). Motives for commercialization of ANS include increasing airspace congestion, the requirement to replace equipment and facilities that were becoming obsolete and economic pressures on operating costs. In particular, the trend of commercialization is driven by:

- Financial constraints and ability to user-fee-based and private capital market-based finance;
- Improve the strategic position of the ANSP in view of potential participation in international ANS ventures;
- Create an incentive for the ANSPs management to operate in a business-like and client oriented way.

Traditional ANSP business model was structured around operating and managing air navigation services and was regarded as a part of transport infrastructure by providing airlines with the necessary resources to conduct their business. With the introduction of SES initiative, the aeronautical revenues have come under significant pressure. In reaction to this, the most advanced ANSPs broadened their business operations and attempted to increase share from non-aeronautical, as profit margins from this sector are typically higher. Non-aeronautical revenue is an attractive figure for managers and investors; also, it allows mitigating the possible safety risks generated by periodic economic downturns in the air transport industry (A. Tomova, 2016).

To reflect changing market dynamics, the new business models were developed by splitting the commercial business from the business financed by air navigation charges. It takes forms of alliances, consortias, industrial partnerships, joint ventures, service provision partnerships or internal business units. The most common examples of commercial activities are consulting, engineering, aeronautical information data, aerodrome control services, training and elaboration of new ATM systems. Participation in commercial activities and business diversification is dependent on status of ANSPs. While ANSPs are mostly state-owned companies, participation in various partnership forms or restructuration of service provision with aim of better financial performance leads to changing of legal status and ownership forms of ANSPs. At the moment rethinking of ANSPs legal status and ownership forms is one of the most relevant issues in Europe and worldwide.

There are plenty of forms and models of partnership across the different business areas. In the ANS industry, the most popular and widespread forms of partnership are public-private partnership (PPP), FAB and inter-FAB cooperation, alliances, consortias, industrial partnership, service provision partnership and networking. The main goal of those partnerships, imposed by Single European Sky legislation, is continuous improvement of ANSPs performance. This could have a positive effect on ANSPs, entrusting their business continuity, opening of new opportunities, diversification of their sources of incomes and reducing the expenditures, and to society – main airspace users / airlines (end-users – passengers), overall people’s mobility, environment pollution reduction and economy growth.

The following forms of partnership will be analysed from a theoretical perspective (see Figure 7).

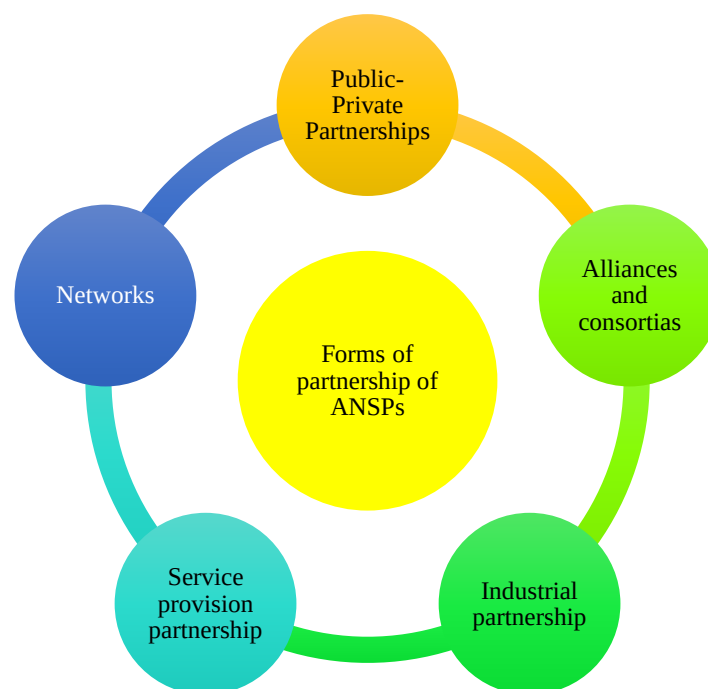


Figure 7. Forms of partnership of ANSPs

Source: compiled by author

Public-Private Partnerships. Collaborative activities between all sectors have become more recognized and widespread in the past 30 years, and this has resulted in revolutionary change in institutional forms of governance. Examples of collaborative alignment include partnerships among three main societal sectors – government, businesses, and civil society. The main goal of those engagements is to tackle social issues and causes. Cross-sector partnerships differ in a great amount, starting with the scope, size and objective. They also differ from duets to multiparty agreements, from local to global, short or long-term, and from volunteer to fully mandate. In addition, all sector organisations face the pressure of changes and increasing public expectations, which is one of determinants of collaborating up across sectors. Many scholars have tried to define cross-sector partnerships, but they still struggle to accept one common definition, that is why the terms vary (M. Leontescu, E. Svilane, 2012) (see Figure 8).

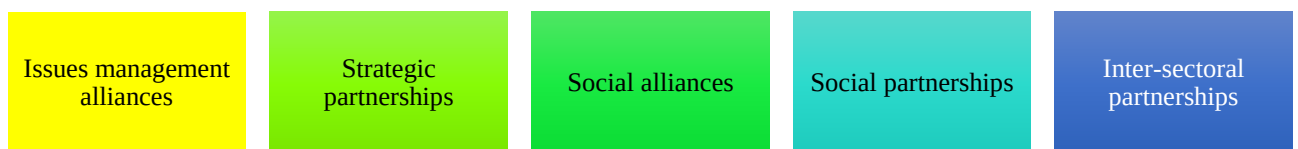


Figure 8. Cross-sector partnerships forms

Source: compiled by author according to M. Leontescu and E. Svilane (2012)

Public-Private Partnership (PPP) is one of type of cross-sector partnerships. There are several definitions of PPP (see Table 3). From a public policy perspective, the major objective of a PPP is – a notably improve of the quality and efficiency of a given service / product to the citizen. At the same time, it would have the benefit of attracting private resources into public services, thereby allowing public money to be diverted into other critical areas and alleviating long-term pressures on public finances. The literature in the field of PPPs states that those partnerships are managed through numerous of agreements, contracts and legal procedures that define the relationships and mutual benefits clearly. Detailed regulation of organisational arrangements to specifically combine resources and activities is probably the most important requirement for high partnership performance and it has been proven more beneficial than standard organisational models. In addition, the organisational arrangement is a core of coordination mechanisms. Within this mechanism the management should recognize ties that should be strongly coupled and ties that can be loose enough, in order to achieve better results (Jomo KS et all, 2016; M. Leontescu, E. Svilane, 2012).

Looking for the improvement of their innovativeness, organisations could gain knowledge and experience from networks with external stakeholders. In order to do so, organisations complement or even substitute their existing organisational structures with the network structures, so that the hierarchy flattens out in favour of new organisation forms.

Table 3. Definitions of public-private partnership

Author	Definitions	Dimension
H.M Treasury (1998)	An arrangement between two or more entities that enables them to work cooperatively towards shared or compatible objectives and in which there is some degree of shared authority and responsibility, joint investment of resources, shared risk taking, and mutual benefit	▪ Interorganisational relationship ▪ Cooperation ▪ Shared objectives ▪ Joint investments ▪ Risk sharing
Forrer et al. (2010)	Public-private partnerships are on-going agreements between government and private sector organizations in which the private organization participates in the decision-making and production of a public good or service that has traditionally been provided by the public sector and in which the private sector shares the risk of that production	▪ Interorganisational relationship ▪ Risk sharing
Knowledge Lab (2015)	Public-private partnership is a long-term contract between a private party and a government entity, for providing a public asset or service, in which the private party bears significant risk and management responsibility, and remuneration is linked to performance	▪ Interorganisational relationship ▪ Risk sharing ▪ Remuneration based on performance
Grimsey & Lewis (2005)	Partnership, when organisational representatives from two or more economic sectors in cooperation put their collaborative efforts, trying to overcome a mutual social issue or a problem that is identified through a public policy agenda. In particular, in a long-term contract, which requires strict performance regimes	▪ Interorganisational relationship ▪ Cooperation ▪ Shared objectives ▪ Risk sharing
Kernaghan (1993)	A relationship involving the sharing of power, work, support and/or information with others for the achievements of joint goals and/or mutual benefits	▪ Interorganisational relationship ▪ Cooperation ▪ Power and information sharing ▪ Shared objectives

Source: compiled by author according to Jomo KS et al., 2016; M. Leontescu and E. Svilane, 2012; Knowledge Lab (2015)

J. W. Selsky and B. Parker (2005) questioned the efficiency of PPPs. This partnership model has been contested for almost as long as it has existed. Although studies examine PPPs in a positive and instrumental way, however some criticism provided on process or outcome grounds. Researches arguing what indicators could reflect the positive added value of PPPs. It was concluded that PPPs have substantial problems: they may decrease costs of services for public /users in the short term, but only if cost and efficiency are defined narrowly and external factors have not been taken into account. PPP partnerships do not necessarily exhibit superior performance in terms of equity, access, or democracy. Moreover, they do not necessarily reduce regulation because government still must fulfil its roles as protector of the public good. Regarding accountability, public partners are the providers of last resort, although this could change if private partners gain more experience and collaboration transforms into better-developed policy partnerships.

In summary, PPP is a highly formalized partnership model, regulated by government or international organisations, where private resources attracting into public services are aimed at improvement in the quality and efficiency of a given service / product to the citizen. Public sector could use this opportunity to increase its overall performance and value. For the measurement of the

positive benefit of above-mentioned partnership model for society right performance or output measurement, indicators necessary to be established and appropriately monitored.

Alliances and consortias. Alliances have attracted a lot of attention in management sciences. They can be characterized as “relatively enduring inter-firm cooperative arrangements, involving flows and linkages that utilize resources and / or governance structures from autonomous organizations, for the joint accomplishment of individual goals linked to the corporate mission of each sponsoring firm”, or as “a collective, voluntary organizational association that interactively engages its multiple members in multilateral value chain activities, such as collaborative research, development, sourcing, production, or marketing of technologies, products, or services. Forms include research and development consortia, official and de facto standard-setting or -promoting associations, multiparty production joint ventures, supplier networks, co-marketing arrangements, and industry constellations” (C. Menard, 2011).

Researchers revealed the performance implications of some unique aspects of multipartner alliances. First, implications of timing of entry. Second, organizational involvement effect by demonstrating the disparity between common benefits and private benefits due to extensive internal involvement and by accounting for follower advantage in multipartner alliances. Third, competition between alliance constellations by highlighting the merits of simultaneous membership in competing multipartner alliances (D. Lavie, C. Lenchner, H. Singh, 2007).

Participation in competing alliances enhanced productivity and market success despite potential efficiency losses. Early alliance entrants gained market success, and both early and late entrants were more productive than intermediate entrants were. These findings illuminate multipartner alliance complexity and disparity between common and private benefits.

In recent years, multipartner alliances have gained popularity, especially in technology-driven industries. A multipartner alliance is a collective, voluntary organizational association that interactively engages its multiple members in multilateral value chain activities, such as collaborative research, development, sourcing, production, or marketing of technologies, products, or services. Forms, include R&D consortia, official and de facto standard-setting or -promoting associations, multiparty production joint ventures, supplier networks, co-marketing arrangements, and industry constellations (D. Lavie et al, 2007; C. Manard, 2011).

Nowadays alliance and consortias of the most popular partnership forms. It is affected by non-strict requirements for the creation / establishment of those partnership forms. ANSPs alliances are oriented on technological partnership, cooperation in research and development, industrial research activities and common presentation of their voice on international fora. Thus, these partnerships may become more important than FABs in driving at least technological progress.

Industrial partnership. Industrial partnership is a term widely used in Single European Sky (SES) legislation. Integra (2016) states that in the longer term political goals of SES are unlikely to be achieved by airspace changes alone – they require fundamental changes in the configuration of operations to reduce the costs of service, which may only be achieved with strong political will at state-level. In the absence of such political will, alternative approaches to drive improved performance such as the industrial partnerships have emerged. Industrial partnership could be defined as a type of cross – sector partnership, where one or more partners give their expertise to the business, rather than investing money. Industrial partnership is a platform for ongoing collaboration around one or more related issues, aligning partners in support of common agenda and joint efforts / investments. Industrial partnership widely known in educational area. There are summary of key lessons needed to make a partnership work well provided specifically to educational organisations, but which could be applicable for development of ANSPs’ industrial partnerships (G. Edmondson et al. 2012) (see Figure 9).



Figure 9. Recommendations for development of ANSPs’ industrial partnerships

Source: compiled by author according to G. Edmondson et al. 2012

Since beginning of 2000’s some ATM systems producers start organising „interest clubs“, i.e. means group of countries using their equipment. First idea, caused by variety of ATM systems and its versions, was to improve interoperability between systems even of one manufacturer. Second one

– ANSPs was looking for cost reduction, risk sharing with partners and possibility to influence development of requirements or even some parts of the future system. This initiative, called as – industrial partnership was very welcomed and supported by Commission in SES-II legislative package. Commission support all the forms of partnership, which support implementation of SESAR and could improve network performance (EC Regulation 549/2004, SESAR JU, 2012).

In summary, industrial partnership would create the preconditions for obtaining a synergy effect, promote a coherent, consistent, sustainable development and modernisation of the ATM system, create new patterns of partnership, and a common, coherent decision-making and its further approval would become the norm. Possibly, this kind of bottom-up partnership, could gain more benefits as for ANSPs and network wide than well-known FAB partnership.

Service provision partnership. Such partnership model as service provision partnership has not been described by researches. In scope of ANSPs it means - cooperation in the provision of ANS (FAB, Inter-FAB, and Strategic Alliance) and cooperation in the provision of support services. Besides cooperation's mentioned above, it should be noted, that in 2012 Eurocontrol has proposed to centralize some services, thus unbundling the current air navigation services into those delivered at the air space block (FAB) level, and those provided at the central (network manager) level. Such unbundling could serve as a first step towards the gradual centralization of all air navigation services. Some of the operational solutions are too attractive to be discarded, though others bear a real risk that an even larger (operational) monopoly is being created, which is certainly not in line with the EC's liberalization agenda. Since 2014, many ANSPs has participated in Calls to become a members of Centralised services (particular information on participants is confidential), such kind of service provision partnership. This participation foster creation of numerous consortias, what make a good basis for communication of ANSPs and industry partners, generating new ideas, and making contacts, which could be beneficial for them in the future.

Service provision partnership could be described as interorganisational relationship, cooperation, shared objectives, joint investments and risk sharing to PPP and in some aspects to industrial partnership, however has its distinctive features. In summary, service provision partnership is a combination of various partnerships models described in previous chapters joined by one common goal, to provide together some kind of services. The aim of such partnership to make a profit, enhance their performance and to occupy the part of EU ANS market.

Networks. Attention to networks as an object of management partnership has been growing for 30 years. Contemporary networking theory is closely related to various fields of public and private management and strongly affected by developing of network concept in mathematics, computer science and sociology. Even with a constantly growing interest, still, there is no common agreement

on the definition of the network. Table 4 shows the most relevant definitions of network (J. Nugaras, 2014).

Table 4. Definitions of network

Authors	Definition
Euler (1736)	Is an object consisting of points, also called <i>vertices</i> or <i>nodes</i> , and lines, and called <i>edges</i> or <i>links</i> .
Herbst (1976)	The basic characteristic of a network is the maintenance of long-term directive correlations, mutually facilitating the achievements of a jointly recognized aim” and a network is “...appropriate when a number of different organizations become involved in a relatively continuous and long-term change process.”
Gulati (1995;1998), Das, Teng (2002) Nugaras, Radzevičienė (2009)	A network is defined as a set of relationships that binds a group of independent organizations together.
Chisholm (1998)	“a set of autonomous organizations that come together to reach goals that none of them can reach separately”
Castells (2000)	A network is a set of interconnected nodes. A node is the point where the curve intersects itself.
Borgatti, Foster (2003)	A network is a set of actors connected by a set of ties. The actors (often called “nodes”) can be persons, teams, organizations and concepts. Ties connect the pairs of actors, can be directed or undirected and dichotomous or valued (measured on a scale).
Glückler (2007)	Formal or informal relationships between individuals (e.g. entrepreneurs, employees) or organizations (e.g. firms, projects).

Source: J. Nugaras, 2014

Researchers (Lazzarini, 2001; IMP group, 1982-2012; Håkansson, et al. 2009, and others) defined the following types of networking (see Figure 10). All these types of networking are used today by ANSPs with aim to improve their competitiveness and overall performance.

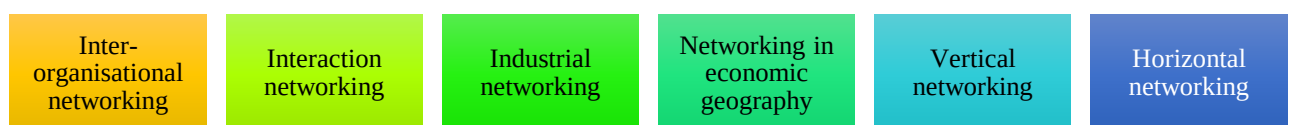


Figure 10. Types of Networking

Source: compiled by author according to Lazzarini, 2001; IMP group, 1982-2012; Håkansson, et al. 2009

In the first phase of networking development exchange between two organizations (*inter-organisational networking*) were core emphasized, later it was understood that Inter-firm relationships can be a source of competitive advantage (Dyer, Singh 1998), and network analyses have focused on distinct types of interdependencies involved in inter-organizational collaboration (Lazzarini et. al., 2001). One of the most influential approaches on inter-decencies in business and networking formation, processes and structures is research done by Industrial Marketing and Purchasing (IMP) group (Håkansson 1982; Håkansson, Snehota, 1989; Ford 1990; Håkansson, Snehota 1995; Gemunden, et al. 1997; Naude, Turnbull 1998; Ford 2002, Medlin, 2004, Abrahamsen, et al. 2012) were the concept of interaction developed and proved by a number of empirical studies.

Interaction is a process that occurs between companies and changes and transforms the aspects of the resources and activities of the companies involved in it and the companies themselves. In addition, IMP studies emphasize that the interaction between individually significant companies is a primary characteristic of the business landscape. The implication of this observation is that it is not what happens within companies but what happens between them form the nature of business. It is through combining resources and linking activities with each other actors develop, create value for each other and address problems to each other. It is only through others that business actors can acquire their respective and collective identities and roles. It is through the interaction with others that business actors learn, teach, serve, utilize and become appreciated (Håkansson, et al. 2009). However, in exchange relations, the parties tend to merge past, present and future in a continuum thus taking into account experiential learning in relation to past interactions with the same party and experience from other interactions with whom the focal party has conducted or is conducting relationships (Webster 1992). This creates collaboration between two parties a longer-term perspective. Collaboration represents a departure from discreteness that underlies spot market transactions toward a more relational approach. In collaboration, action moves from transaction to joint activities, including joint problem solving and joint planning (Dyer, Singh 1998; Heide, John 1990; Goldkuhl, Melin 2001; Claro D., Claro P. 2010). Interaction always affects resources and people that are involved in it and activities they perform (Wilk 1996, Håkansson, et al. 2009).

All companies simultaneously interact with many others, and the interaction between any two companies affects their interactions with these others. This network of connections between interaction processes leads to modifications to activities, resources and companies across many organizational boundaries. Being a ubiquitous process, interaction also forms a working structure for the network and provides an element of stability to how different companies relate to each other in the network (Ford, Håkansson 2006; Håkansson, et al. 2009).

Another approached by the same IMP group is *industrial network* approach that challenges the idea of the autonomous company making autonomous decisions. Business relationships are explained from the view that companies engage in relationships in order to reduce costs and to exert control (Abrahamsen 2009). In addition, a company can select a marketing segment and obtain a desired position in this segment based on some autonomous strategy decision and hence develop a product that will attract the attention of potential customers through market communication activities, determine a pricing policy based on the forecasted demand and decide upon a marketing channel that most efficiently transfer the product from the manufacturer to end users (Kotler et al. 2009). Industrial network perspective challenges this general marketing perspective. In marketing, the customer's (B2C B2B) task is to act favourably in terms of buying the product in question, which finds the customer as being an active part of developing relationships. The success of a company may be

explained by its ability to develop and handle the interconnectedness of its relationships and a wider network. This implies that the company is not an isolated unit making autonomous decisions; it is linked to the larger environment by its interconnected relationships (Håkansson, Snehota 2006; Abrahamsen 2009). In business, those approaches are realized in forms such as cooperation (Jaržemskis 2007; Stein, Ginevičius 2010; Zeng, et. al. 2010), strategic alliance (Gulati et al. 2006), partnership, supplier relation (Achrol 1997), joint venture, franchising, licensing, etc.

Networks in economic geography: the relation between geography and networks can be theorized in (at least) two ways: First, *proximity affects network formation*. The most widely used approach in economic geography aims at assessing the latent effects of physical proximity/distance on economic processes. Second, *place makes a difference*. A place-specific resource profile conveys a source of contextually, difference and contingency for economic development (Bathelt, Glückler 2007), but geographical location is a non-relational condition that may strongly affect the evolution of the network trajectory. Both aspects are combined and investigated in the analysis of clusters (tight networks in some geographical location), either from the perspective of regional or sectorial development.

Despite of using Inter-organizational theory, Networks in economic geography, Industrial networks and Network Governance to investigate networks *Vertical* and *Horizontal* structures are usually used and analysed (Boschma, Wal 2007; Mason, et al. 2007; Jindraa, et.al. 2009; Gebauer, et al. 2012).

Vertical networks are more applicable in value delivering *activities* in the product market and managing marketing channels. Literature mostly analyses vertical networks from the perspective of the systemic interaction of the focal company that supplies consumers (Golfetto et al., 2007; Zerbini, et. al. 2007; Dogan 2009). The development of the vertical networks is closely related to the development of the value for client delivery. In the 1990's, this function was seen as a competitive advantage as well as a complex process that could not be restricted to the border of an individual company. With the growth of understanding that, in order to improve the overall service offered to the end customer at minimum cost and with high flexibility, companies should cooperate and coordinate their activities (Jahre, Fabbe-Costes 2005). Companies and even public sector organizations worked hard with downstream and upstream partnerships as well as with those with their logistics providers. By participating, several supply chain firms formed complex network structures (Christopher 1998, 2005). However, the main player in the vertical network is a focal organization that performs very few core functions and often referred to as an "integrator", that is, the firm that organizes the network and coordinates all upstream and downstream firms. Thus, a vertical market network can be defined as the *organization set* of direct supply or distribution relationships

organized around the focal organization best positioned to monitor and cope with critical contingencies faced by network participants in a particular market (Achrol 1997).

Horizontal networks concentrate practices between companies operating at the same level(s) in the market and capture network actors and activities across multiple value chains (Gebauer, et al. 2012). In addition, it is common to approach horizontal networks as those usually made up of entities that bring distinctive competencies into collaboration. Such networks have been formed to be engaged in innovation activities and new product development and have been referred to as innovation driven horizontal networks (Oke et al. 2008). Horizontal relationships are more informal and invisible and are built mainly on information and social exchanges (Bengtsson, Kock 1999). Moreover, it is considered as one of the ways to manage costs down as well as achieve the required service levels and to extend the notion of collaboration on a horizontal plain to potentially include complimentary players and even competitors (Christopher 2005).

Above discussed network, concepts and main networking theories indicated multi angle approaches and complex field of analysis of relational environment that forms different structures effecting understanding and management of business companies and public entities. In the previous section the focus was given strengthen the understanding of structures and processes existing in the environment of the entity. This more structural approach does not explain the main reasons and motivation for entities to participate in network structures – a close look to the main motivating criteria as well as the obtained results and outcomes are given in the next chapter there networking implications to strategic management are also discussed.

Nugaras (2014) stated that networking is highly related to strategic goals achievement processes of the organisation / entity. Benefits that could be gained from relations with external environment and to be considered in the strategy of the organisation / entity and are summarized in Table 5.

Table 5. Benefits and outcomes of networking

Benefits and outcomes of networking	Impact	Authors
Competitive advantage	Networking creates unique and difficult to copy competitive advantage	Dyer, Singh (1998)
Complementary resources	Sharing human resources could help with using synergy in the conscription of resources. Sharing could assist in buying more technologies; if technology is constant, less money could be spent.	Spekman, et. al (2000) Lavie (2006); Hakanen, Jaakkola (2012)
Decrease in opportunistic behaviour, risk sharing	Trust and close long term relations could prevent from the opportunistic behaviour of the partner	Moeller (2010)
Economy of scale, better usage of operational costs	Companies in horizontal networks in the same sectors use more or less the same materials, so they could use	Joglekar, Lévesque (2012)

Benefits and outcomes of networking	Impact	Authors
	economy of scale in order to get cheaper materials	
Development, survival and profitability of the participating entity, small business development	Networking increases the possibilities of entities in the network	Street, Cameron (2007); Gilsing, et al. (2008); Busquets, et al. (2009); Anon, (2003); Oke, Idiagbon-Oke (2010)
Organizational learning and access to information, learning from partners Common language and shared mental models	There are better abilities to learn and access information for the companies in networks	Lawson et al. (2009), Dyer, Hatch (2012), Senge (2006)
Access to local and international markets	Participation in networks increases abilities to access local and international markets	Oke, Idiagbon-Oke (2010); Fletcher (2008)
Faster and better innovation, higher R&D, costs for a reduction in R&D	Synergy of resources, competitive advantage	Enkel et al. (2009)
Reduction in bureaucracy and management costs	Faster and cheaper value delivery	Park (1996)

Source: J. Nugaras, 2014

Networks and networking can be considered as a tool used to reach above listed benefits or an activity that should be undertaken by the organisation / entity in order to survive in modern and fastly changing environment. Networking should be considered as useful partnerships managing tool and important element of strategy development and implementation.

1.2.3. SUMMARY OF MODELS OF PARTICIPATION OF ANSP IN DIFFERENT PARTNERSHIPS

In summary, widely known multi-stakeholder partnerships models such as alliances, consortias, joint ventures / projects and cross – sector partnership as PPPs, and highly growing, thanks to internet technologies – networks are existing in European ANSPs landscape. Some of them transform into new models, not known in other sectors of economy or public services – FABs and industrial partnership. However, it should be noted that FABs and Industrial partnership have features of multi – stakeholder partnerships and cross – sector partnership. What is common for wide known models of partnerships and ANSP specific ones are goals of them: to acquire expertise and access to needed resources, faster and better innovation, higher results of research and development activities and costs reduction, to cope with turbulence in their environments, to accomplish objectives they are unable to bring out alone, to address stakeholder’s demands and develop or sustain a competitive advantage, and ultimate one applicable to the ANSPs - to improve overall performance. However, not only positive aspects of multi-stakeholder partnership models were defined by researches. Such performance implications as timing of entry, organizational involvement effect by demonstrating the disparity between common benefits and private benefits due to extensive internal involvement and

by accounting for follower advantage in multipartner alliances, and competition between alliance constellations by highlighting the merits of simultaneous membership in competing multipartner alliances, were defined. To assess the impact of involvement of European ANSPs in different partnerships on their performance is one of the main goals of this thesis.

Specific to European ANS market approaches to partnership caused by international and European Single European Sky legislation, should to be mentioned. Those approaches are classified as top –down (imposed by legislation), bottom –up (particularly ANSPs initiative), and mixed one (when legislation just give the possibility to create some forms of partnership and ANSPs using this chance). Having in mind above said, partnership models could be clustered by “approach” category (see Figure 11).

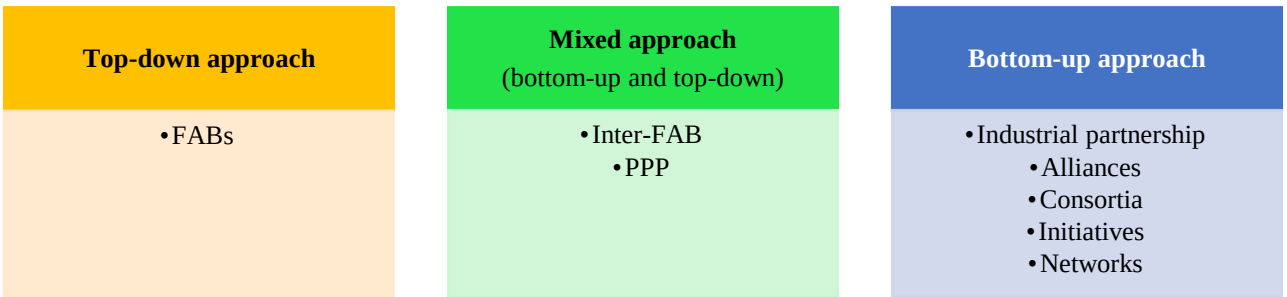


Figure 11. Clusters of partnership models in ANS industry

Source: compiled by author

1.3. REVIEW OF EMPIRICAL STUDIES INVESTIGATING THE IMPACT OF ANSP’S INVOLVEMENT IN PARTNERSHIPS ON ITS PERFORMANCE

ANSPs in Europe operate in very diverse environments, both in terms of operational conditions (e.g. traffic complexity and traffic variability) and socio-economic conditions (e.g. cost of living, labour laws). The literature provides two main streams of empirical researches investigating the impact of different exogenous and endogenous factors on ANSP’s performance.

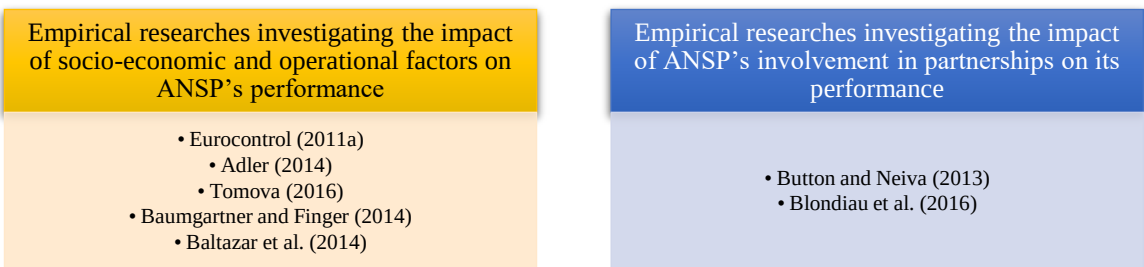


Figure 12. Two main streams of empirical researches investigating the impact of different exogenous and endogenous factors on ANSP’s performance

Source: compiled by author

Most of scientists' focus on investigation of the impact of socio-economic and operational factors on ANSP's performance. Eurocontrol (2011a) has performed a research on the impact of exogenous factors on the cost-effectiveness of ANSPs. They adopted a statistical modelling approach based on the estimation of a Cobb-Douglas cost function³, which describes the relationship between the costs and output(s), input prices, exogenous factors describing the ANSP operating environment and an error term⁴. They have used the relatively "small" data set (i.e. 8 years from 2002 to 2009 and 250 observations). They have used the logarithm of the total costs of gate-to-gate service provision in ANSP as dependent variable and a set of explanatory variables (output, input prices, and environmental variables)⁵. The environmental variables were used in addition to the output and input prices, which feature in cost functions to decompose part of the other differences in costs according to measurable differences between ANSPs. The main findings of Eurocontrol's study are that the level of inefficiency of ANSPs is within the threshold provided by two different models [13%-60%] since time invariant differences across ANSPs are probably due to both inefficiency and to specific factors reflecting local circumstances. Network concentration, traffic variability and airspace controlled by ANSP contribute to explaining ANSPs inefficiency. In addition, the results suggest that the inclusion of environmental variables has a lower impact on the estimated inefficiencies of ANSPs. The econometric analysis performed by Eurocontrol shows that the assumptions taken on the error term have a large impact on the inefficiency estimates and on the relative positions of individual ANSPs in the overall distribution of the inefficiency measure.

Baumgartner and Finger (2014) examined gradual liberalization of European air transport industry and identified the main actors (in particular ANSPs) of the SES along with their often conflicting interests, those factors impacting legislation, introduction of performance scheme, and major recent problems of the SES. The paper was grounded on organizational behaviour theory and institutional economics and was written from a political science perspective analysing EU legislation, official analysis reports and studies of other researchers related to the question. Time scope of the analysis from 1987 until 2013. The paper underlined the intention of the EC to make an enforcement on ANSPs and improve the existing rules with aim to enhance the efficiency of the SES by orienting the focus of the ANSPs on customer needs, in particular, the delivery on performance, increasing

³ The framework they considered consist of a Cobb-Douglas cost function which postulates a log-linear relationship between total costs, output, input prices and environmental variables. The main advantage of the Cobb-Douglas functional form is that it assumes a simple parametric relationship between total costs and explanatory variables. As this relationship is estimated in logs, the coefficient of the cost function can be interpreted as long-term elasticity (e.g. impact of a 1% change in output on costs). Alternative specifications typically used in econometric cost-benchmarking include quadratic functional forms and particularly the translog. These specifications may provide more flexibility and better reflect the characteristics of the industry but they require the estimation of a larger number of parameters and this may be difficult if the data set is not sufficiently large.

⁴ The error term mainly reflects the fact that it is impossible to capture every influence on an economic variable in a theoretical model and account for measurement errors (i.e. it is very difficult to obtain accurate measures of all the variables included in an econometric model).

⁵ They have used composite flight hours as output measure and the main cost drivers including 1) measures of traffic complexity, traffic variability, concentration of traffic by airport movement (in a given country) and of the size of airspace controlled; 2) direct measures or proxy measures of the price of key inputs for ATM/CNS provision (labour, capital, other inputs); 3) the quality of the economy wide business environment; 4) the effect of time (which may be a proxy for the impact, common to all ANSPs, of different global economic shocks, changes of regulation affecting all ANSPs and other common trends that may shape ANSPs operations).

efficiency of the support services, and removing the fragmentation of the European ATM system by enabling industrial partnerships (namely in FABs). They concluded that there are too many actors involved with two conflicting interests to be able to agree. The airspace users (airlines) and the EC are the only actors who have a clear interest in the SES. However, airlines are too weak and particular power and the interests will be on the manufacturers and the Member States side. Baumgartner and Finger (2014) stated that the Member States are not in favour of the creation of a SES, including creation of FABs and liberalization of ANS considering the interests of their ANSPs, the unions, the airports and the military.

Adler (2014) and Tomova (2016) discussed the role of commercial revenues in the economics of European ANSPs. Commercial activities are one of the possible solutions to improve performance in cost-efficiency area. Industrial partnership is paramount to achieve this goal. The capital intensity of newly emerging sophisticated technologies explains why several ANSPs have started to join funds with other ANSPs and/or private capital companies to achieve the desired technological progress. It also was stressed that the commercial business of European ANSPs would not be possible without changes to the ANSPs governance (corporatisation and with regard to British NATS privatisation). Adler (2014) and Tomova (2016) summarized that since introduction of SES II a higher competition level was observed in ANS industry, which was traditionally structured and managed as regulated nationally, and/or on a wider supranational basis. Taking into account latest trends, the EC will inject more market mechanism into the ANS industry, such as restructuring the ANS industry through product unbundling of support ANS services. Only those ANSPs, which have already implemented commercial models will be better prepared for such structural changes and more resistant to mergers and acquisitions. ANSPs having an experience in industrial partnership or with commercial business will be more competitive in the more liberalised European aviation market.

Baltazar et al. (2014) focused on airports and ANSPs (providing activities of this airport) desiring to improve their performance in align with their strategic business objectives, with the objective to develop predictive models of performance and efficiency using robust, but flexible methodologies, and incorporating traditional indicators as well as new constraints. Research based on two multidimensional tools: Multi Criteria Decision Analysis (MCDA by Measuring Attractiveness by a Categorical Based Evaluation Technique - MACBETH) and Data Envelopment Analysis (DEA), comparing the efficiency evolution of the same airport along several years (2006-2011), under several constraints. There were two main research lines on airport/ANSP performance: the productivity evaluation approach and the efficiency evaluation approach; the difference lies in a concept of maximum attainable outputs. The study results showed that MACBETH (MCDA) approach looks to be a very promising one when compared with those (DEA based which was under research by Button and Neiva in 2013) traditionally in use. In addition, it can be applied in managerial

practice involving in the process the stakeholders. However, improvements / developments should be done in this area mainly with focus on most significant sets of indicators to airports/ANSPs managers, to evaluate emerging situations; to search for the best robust and flexible multidimensional tools; to improve the self-benchmarking process.

Only a few empirical studies provide some insights on the impact of ANSP's involvement in partnerships on its performance. Button and Neiva (2013) examined the potential economic efficiency of on-going changes in the European air traffic control system. The European Commission created the SES initiative with the aim of treating European airspace as a single entity, instead of being a patchwork of all the different national systems. A major transitional component of this initiative is the notion of functional airspace blocks (FABs), which are intended to aggregate several individual ANSPs into larger entities that would handle air traffic as if they were a single ANSP. To study the effects that those changes might have on the economic efficiency of the system, a data envelopment analysis framework was used in their study. Although these FABs were not yet deployed, Button and Neiva (2013) simulated, *ceteris paribus*, how these different systems would have ranked in terms of economic efficiency by using data for each individual air navigation service provider. The approach adopted in their study deploys standard data envelopment analysis (DEA)⁶ with variable returns to scale. Button and Neiva (2013) have used the data reported for individual ANSPs for 2002 through 2010, which have been aggregated, at the FAB level to simulate the operation of the European airspace under that paradigm. The base DEA analysis involved two inputs to the production of ANSs, both measured in financial terms for consistency, and three outputs⁷. The study provided very little insights into the nature of the FABs, looking at their relative efficiencies over time and some factors that may explain differences. According to Button and Neiva (2013), with the exception of the Danube and South West FABs, all other blocks tend to consistently stay above the same level of efficiency.

Blondiau et al. (2016) developed an economic public utility model to analyse the effects of the SES performance regulation on ANSPs performance. Major problem raised by authors, EC and Eurocontrol was low level of cooperation between various national ANSPs, large differences in productivity between them, slow adoption of new technologies and low degree of equipment standardization. They have investigated incentives for ANSPs through the development of a high-level economic model, which allows assessing impacts at a strategic level and deriving high-level

⁶ The approach is preferred over parametric techniques based on regression analysis because there is no need to explicitly specify the production or cost function in determining the relative efficiencies of the ANSPs that constitute the FABs. The technique also allows the consideration of multiple inputs and outputs that are relevant in the ANS context and does not require them to be converted into monetary units. It is appreciated that DEA is sensitive to such things as outliers and that the number of "efficient firms" may expand with the number of inputs and outputs considered, but these do not appear serious issues in this case.

⁷ In their study Button and Neiva (2013) have used two inputs (gate-to-gate air traffic management/communications, navigation and surveillance (ATM/CNS) provision costs, other gate-to-gate costs of non-control services) and three outputs (IFR flight-hours controlled by ANSP, IFR airport movements controlled by ANSP, 1/(Minutes of air traffic flow management delays exceeding 15 min)).

results. The economic model provides insight into the mechanisms through which regulation can drive ANS/ATM performance improvements as well as its limitations. In their work, they applied standard public utility model originally developed by Laffont and Tirole (1993) which has been extended by Dalen et al. (2003) from air traffic management (ATM) service provision in Europe perspective. This model helps to answer to the ATM context related questions: the semi-public characteristic of ANSPs; the heterogeneity among various ANSPs, which makes direct performance benchmarking difficult; historic, national monopoly character of ANSPs and the natural monopoly character of en-route ATM; the likely emergence of special interest groups in this context. Data sources used for research was IATA, Performance Review Body and Eurocontrol reports for the time 2008–2013. The research result shows that hybrid price-caps can be a powerful tool for simultaneously stimulating cost-efficiency and quality of service. In addition, Blondiau et al. (2016) recommended including financial incentives for ANSPs with aim to reach quality performance targets established in the SES II performance regulations.

1.4. DEVELOPMENT OF A CONCEPTUAL MODEL OF IMPACT OF ANSP'S INVOLVEMENT IN PARTNERSHIPS ON ITS PERFORMANCE

While the main objective of this master thesis is to investigate the impact of ANSP's involvement in FAB activity on its performance, a multidisciplinary approach covers all the key aspects/benefits of FAB implementation highlighted in Figure 13. The conceptual model will focus on regulatory/institutional, technical/operational and economic/financial benefits of FAB implementation, in particular, on impact of ANSP's involvement in FAB activity on its performance.

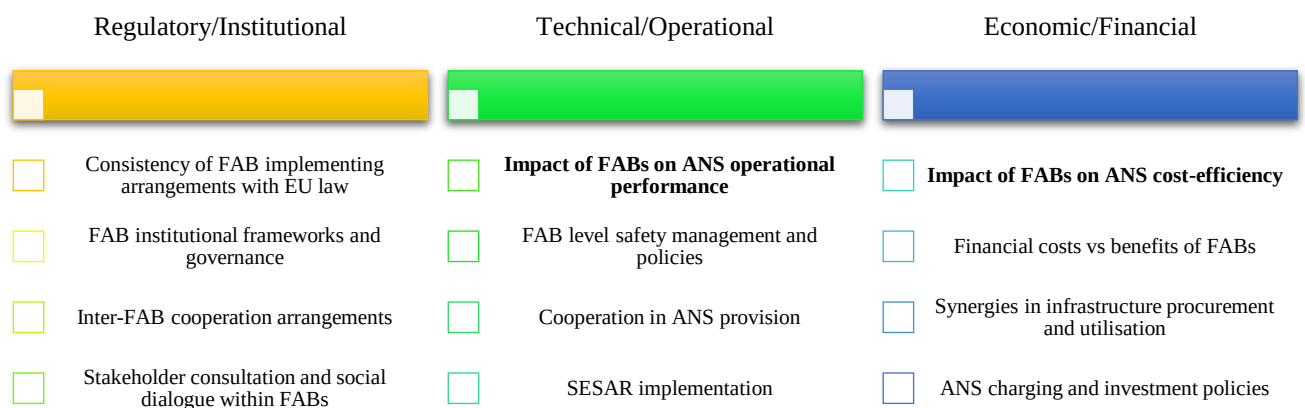


Figure 13. The key aspects/benefits of FAB implementation

Source: compiled by author according to Integra (2017)

Figure 14 illustrates the important distinction between exogenous and endogenous influences on ANSP performance. Exogenous factors are those outside the control of an ANSP, while endogenous factors are those entirely under the ANSP's control.

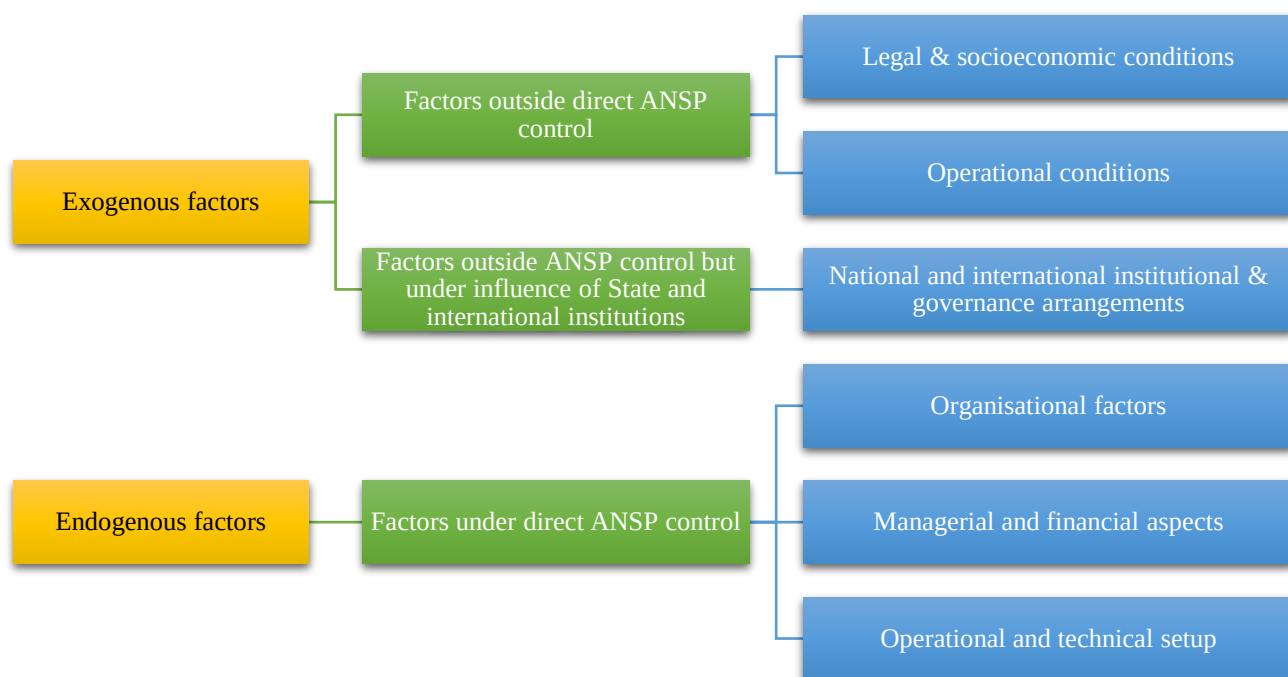


Figure 14. A model of exogenous and endogenous factors potentially affecting ANSPs' performance

Source: compiled by author according to Eurocontrol (2011a)

In Figure 14, exogenous factors that could have an impact on performance have been classified into two main areas (top and central set of factors in Figure 14); according to which decision-makers have an influence over them. Decision makers and conditions outside aviation policy-making affect the top set, comprising legal and socio-economic conditions, and operational conditions. The central set, comprising institutional and governance arrangements, are exogenous to the ANSP but are influenced by aviation sector policy decisions. The legal and socio-economic conditions prevailing in individual countries are affected by national policymakers at a more general level (for example taxation policy), or by national and international macro-economic conditions. The operational conditions, such as the traffic patterns the ANSP has to deal with, are determined by decisions made by airports, airlines, and especially, flying travellers. Operational conditions undoubtedly have a direct impact on cost-effectiveness performance, although the extent and magnitude of the impact is not straightforward to isolate. The institutional and governance arrangements for ANS in a particular country are set in place by the policies and specific aviation laws of each country. These factors are exogenous to the ANSP but decision-making concerning some of them is largely driven by national aviation policy-makers. Some of these factors relate to international requirements such as those imposed by ICAO, Eurocontrol and the Single European Sky. These policies at State and European

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

In principle, once the impact of all exogenous factors has been allowed for, the remaining performance differences should comprise residual inefficiency, which lowers performance below that obtained by best practice. Such residual inefficiency arises from a number of endogenous factors, under the direct control of ANSPs. Endogenous factors – the way that an ANSP manages its business to optimise performance – are influenced by exogenous factors. “Best practice” in any given area will depend on the exogenous circumstances. ANSPs can take action to fully exploit the benefit of their environment or to minimise the impact of relative disadvantages. Therefore, the impact of an exogenous factor should not be analysed in isolation from an analysis of the degree to which this impact has been minimised or maximised through appropriate internal measures. Endogenous factors fall into three groups: organisational factors; managerial and financial aspects; and, operational and technical setup. Not all organisational factors will directly affect cost-effectiveness; some enable or facilitate the achievement of performance when they are set in conformity with the business objectives. Most of the managerial and financial aspects are expected to directly affect cost-effectiveness, since they have an impact, for example, on investment decisions, productivity and wage policies. The managerial and financial aspects are to some extent influenced by the ANSP organisational factors and by some of the exogenous factors (especially among the institutional and governance factors, and among the socio-economic factors). The operational and technical setup of an ANSP is expected to be influenced by both exogenous factors (typically the operational environment) and other endogenous factors (such as internal organisation and investment policy). The operational and technical setup is expected to affect both labour and capital productivity and the level of support costs. A more detailed description of exogenous and endogenous factors potentially affecting the ANSP’s performance is provided in Table 6.

Table 6. Description of exogenous and endogenous factors potentially affecting the ANSP’s performance

Category	Category of factors	Group of factors	Factors
Exogenous factors	Factors outside direct ANSP control	Legal & socioeconomic conditions	▪ Overall business & economic environment - Exchange & inflation rates - Cost of living & market wage rates - Political factors - Taxes on turnover or profit - Accounting standards ▪ General labour law and rules governing industrial relations - Working hours - Retirement age - Social security and pensions

Category	Category of factors	Group of factors	Factors
			Value Added Tax application
		Operational conditions	- Size of the ANSP - Traffic complexity - Density of traffic - Structural complexity - Traffic mix - Spatial and temporal traffic variability - Type of airspace under ANSP responsibility - Weather
	Factors outside ANSP control but under influence of State and international institutions	National and international institutional & governance arrangements	- Regulatory aspects - Information disclosure & independent benchmarking - Overall policy for “market access” - Degree of economic oversight/regulation - Governance arrangements - Institutional structures - Ownership and control structures - Civil/military arrangements - Establishment and implementation of FABs - Involvement of ANSP in FAB activity
Endogenous factors	Factors under direct ANSP control	Organisational factors	- Internal organisational structure - Degree of centralisation - Optimisation of internal processes - Corporate culture - Extent of in-house ownership and activities - Leasing, renting, owning assets - Research & development policy - Outsourcing non-core activities - Human resources - Recruitment and training - Staff/management relationships - Internal communication - Relationship with the customers - Arrangements for customer consultation - Disclosure of audited financial statements
		Managerial and financial aspects	- ANSP management - Top-management leadership and actions - Performance oriented management - Involvement in different partnerships (e.g. consortiums, alliances, etc.) - Collective bargaining process - Financial and accounting aspects - Business planning process - Investment policy - Balance sheet structure - Depreciation policy
		Operational and technical setup	- Operational organisation - Operational concepts and processes - Airspace and sector design - ASM, ATFM or ATFCM - Civil/military arrangements - Operational flexibility - ATM systems & equipment's - Human/system interaction

Source: compiled by author

The major focus of the conceptual model is to examine and analyse the impact of ANSP's involvement in FAB activity and other forms of partnerships on its performance. The proposed model should be seen as an instrument contributing to establish a better understanding of differences in

ANSPs performance. Figure 14 illustrates the important distinction between exogenous and endogenous influences on ANSP performance. Exogenous factors are those outside the control of an ANSP, while endogenous factors are those entirely under the ANSP's control. Figure 15 presents a conceptual model of impact of ANSP's involvement in partnerships on its performance.

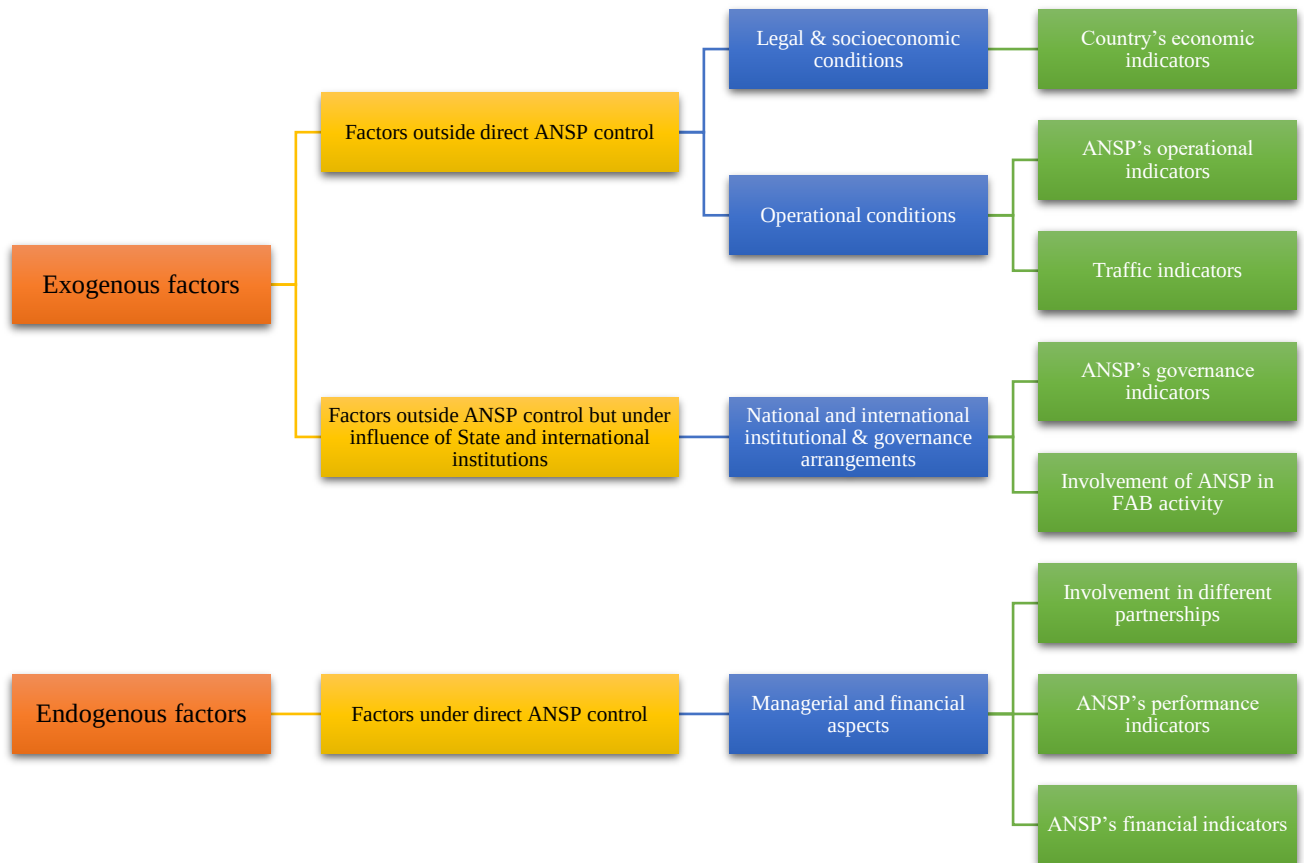


Figure 15. A conceptual model of impact of ANSP's involvement in partnerships on its performance

Source: compiled by author

1.5. METHODOLOGY OF RESEARCH ON IMPACT OF INVOLVEMENT OF ANSP IN DIFFERENT PARTNERSHIPS ON ITS PERFORMANCE

The econometric models used in benchmarking are extensively discussed in the economic literature and are used, among other tools, in regulated monopoly industries (such as water, electricity, gas supply, and surface transport), to support the regulators when developing incentive mechanisms, setting targets or benchmarking different operators. In essence, econometric models can statistically estimate the “average” effect of measurable exogenous factors that affect costs. An important feature of econometric models is that they provide a “confidence range” for the scale of these effects; this information is helpful in assessing whether the actual effect is likely to be close to the average effect. For instance, as the cost drivers include “proxy” measures of the price of the inputs required for the

provision of ANS, the statistical results will quantify the average impact on costs of an increase of the input price and will provide information about the statistical precision of the predicted impact.

The quality of the results will be affected by a variety of factors, including the completeness and precision of the “proxy” measures used for the cost drivers (e.g. the traffic complexity score or labour costs) and the ability of the model to disentangle what is unobserved and contributes to costs from poor performance/inefficiency. Recent advances in econometric modelling provide insights on how to account for no measurable exogenous factors. Nevertheless, it should be acknowledged that each model rests on a particular set of assumptions and that these techniques are more robust when a longer time period is covered and there is a large number of data points.

The extent and size of the various factors affecting performance is not straightforward to identify even when complete data for the relevant metrics or their proxies are available. Given the large diversity (heterogeneity) between ANSPs there is no guarantee that a given operational condition will affect all ANSPs in the same way and it may be appropriate to allow for the effect of cost drivers to differ by ANSP. The toolkit of the econometrician includes many models but there is no superior “one size fits all” approach. Ideally, the chosen model should reflect the specifics of the industry and the specifics of the available data. However, the assumptions underlying the econometric models available may not perfectly match the characteristics of the ANS industry. Two issues in particular may be of relevance when modelling ANS:

- Firstly, the econometric models are based on the standard economic assumption applied to private sector firms in competitive markets that firms seek to minimise their costs (and maximise their profits) by adjusting the way they provide services in response to changes to input prices which they cannot control. ANSPs do not however operate in a fully competitive setting and therefore it could be argued that the objective function is not cost minimization (while ensuring safety standards) *per se*;

- Secondly, there may be concerns related to the potential “endogeneity” of key variables of interest. Endogeneity is a technical problem that arises when key variables are determined within the system being modelled rather than being determined exogenously by the external environment. Endogeneity can be a serious statistical issue as it biases the assessment of the effect of a particular factor on costs. In particular, wages may be affected by this issue. For example, unionization combined with a lack of competitive markets for key workers may imply that the wage levels are determined endogenously in some ANSPs rather than being exogenously set in broader labour markets.

In any case, results will require careful interpretation and cannot be seen as a substitute for other instruments/tools (e.g. factual benchmarking, local audits, feedback from customers, benchmarking of processes, and expert judgement).

The main stages and sequence of research on impact of involvement of ANSP in different partnerships on ANSP's performance are presented in Figure 16.

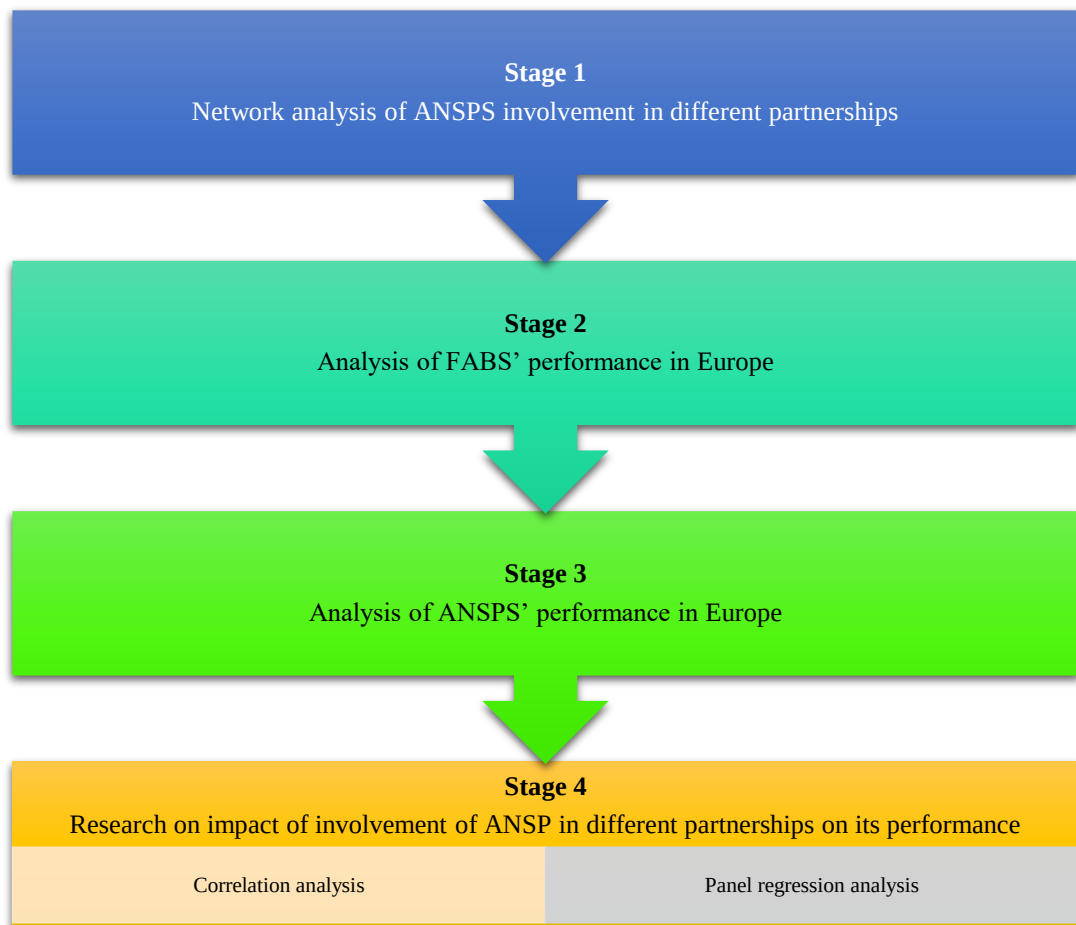


Figure 16. The main stages and sequence of research on impact of involvement of ANSP in different partnerships on its performance

Source: compiled by author

Network analysis of ANSPS involvement in different partnerships. Network analysis of ANSPS involvement in different partnerships will be performed by analysing different forms of partnership of ANSPs as presented in Figure 7:

- Functional Airspace Blocks (FABs) and inter-FAB cooperation;
- Public Private Partnership;
- Industrial partnership;
- Service provision partnership / Joint ventures;
- Alliances and Consortias;
- Initiatives

Analysis of FABS' performance in Europe. At this stage, the following indicators reflecting FABS' performance in Europe will be analysed (Figure 17).



Figure 17. Indicators used for analysis of FABS' performance in Europe

Source: compiled by author

Analysis of ANSPs' performance in Europe. The impact of size on ANSPs performance is an important policy issue given the infrastructure characteristics of the ANS sector. It should be noted that:

- Under the current full cost recovery regime that applies to most ANSPs, they may have little incentive to exploit scale effects fully, hence the difficulty to observe them;
- Larger ANSPs tend to develop bespoke ATM systems internally which can be more costly than a commercial off-the-shelf (COTS) solution, and;
- Size is not the only factor that has an impact on ANSPs costs. It is likely that greater scale effects will be observed in the forthcoming decade because of a new regulatory regime introduced by the SES II Performance Scheme and in particular, of the incentive scheme which is part of the amended Charging Scheme regulation.

At this stage, the following indicators reflecting ANSPs' performance in Europe will be analysed (Figure 18).

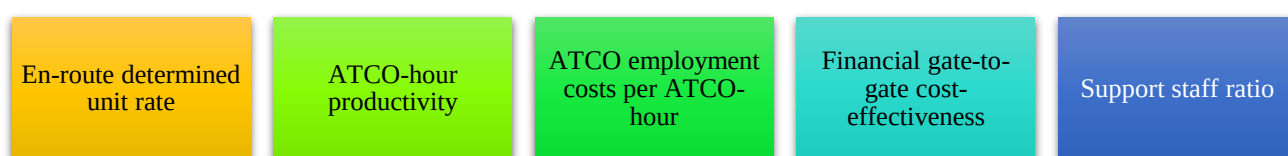


Figure 18. Indicators used for analysis of ANSPs' performance in Europe

Source: compiled by author

Research on impact of involvement of ANSP in different partnerships on its performance.

The differences in exogenous and endogenous factors are important in the ANS industry. The ANSPs provide ANS in contexts that differ significantly from country to country in terms of the environmental characteristics – such as the size of the airspace – and different institutional characteristics – such as the relevant state laws, relationship with supranational entities such as the EU, the stage of development of implementation of European rules, and of course operations and processes.

The economic theory underlying the estimation of a cost function relies on the assumption that firms minimise costs subject to the best available technology. Although a large majority of the European ANSPs are corporatized public entities, in the context of air navigation service provision this assumption may not entirely hold as ANSPs' overriding objective is to maintain safety standards. Furthermore, the European ANSPs are statutory monopolies, which over the last two decades operated under a full cost recovery regime. This means that these organisations are allowed to recover all their costs (though subject to sometime delay) from their customers (airspace users). The single exception to this rule is NATS, which operates under an independent economic regulation regime (i.e. price cap). Therefore, it can be argued that most ANSPs faced relative weak incentives to ensure an efficient use of inputs and to minimise costs during the period considered in this analysis.

The provision of ATM/CNS services requires a combination of inputs, which includes three types of inputs (Figure 19):

- *Labour inputs*: there are two distinct categories of labour employed by ANSPs: Air Traffic Control Officers in Operations (ATCOs in OPS), which accounts for 50% of employment costs on average; and support staff (e.g. trainees, technical support staff, administrative staff, etc.).
- *Capital inputs*: capital inputs used in the provision of ATM/CNS services are varied. They include buildings, controller workstations, various ATM equipment's (with sophisticated flight and radar data processing systems) and CNS infrastructure (such as surveillance radar).
- *Non-staff operating inputs*: the third category, which captures all the remaining inputs, not included in either labour or capital. This category includes, among other things, energy, communications, and the provision of any contracted services.

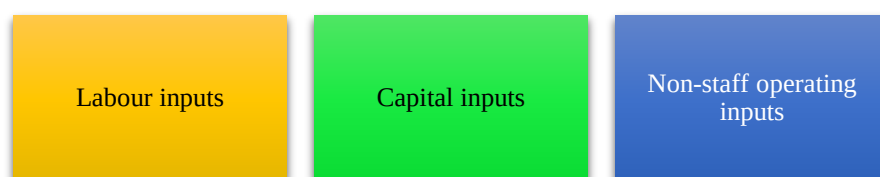


Figure 19. Inputs required for provision of ATM/CNS services

Source: adopted from Eurocontrol (2011b)

Given the level of flights and movements to be controlled, the costs of ATM/CNS provision are affected by differences in exogenous factors and by the ability to manage ANS in a cost-effective manner. The main goal of this research on ANSP performance is to distinguish the contribution to ANSP's performance from exogenous factors, which the ANSPs cannot control (such as the nature of the airspace or being in an area subject to dense traffic and strong seasonality) from weaker performance in controlling costs else equal. Achieving this object requires measures of the different

elements that have been identified as contributing to the costs of service provision. Exogenous factors related to operational conditions are, for the time being, those which have received greatest attention and focus.

The influence of prevailing wage levels on actual employment costs will differ for different classes of staff – for specialised, highly qualified staff such as ATCOs there will be a degree of staff mobility, which will cause some convergence of unit costs, compared with general wage levels.

A number of traffic characteristics that might be expected to have an impact on the cost-effectiveness performance have been grouped together under the generic label of “traffic complexity”. It is a combination of two elements, which give a quantitative representation of the density of traffic and intensity of potential interactions between traffic. In concrete, these two elements are:

- an adjusted density, which is a measure of the concentration of traffic in a given volume of airspace (ANSP level), and defined in terms of minutes of interaction among aircraft per flight-hour; and,
- a structural complexity index, which captures the fact that the traffic in some areas is structurally more complex. The structural complexity index is composed of the sum of three metrics: ascending and descending routes, crossing routes, and variable speeds (a proxy for traffic mix). Clearly, ATC provision in lower airspace will, all other things being equal, face a relatively higher proportion of ascending and descending routes.

Structural complexity and adjusted density are independent. Traffic in an area could be dense, but structurally simple; equally, traffic could be structurally complex but sparse. However, the two impacts are multiplicative; the impact of structural complexity is greater when the traffic is denser.

The relationship between “traffic complexity” and cost-effectiveness, or ATM performance in general, is not straightforward. The effects of traffic complexity on ATM performance can work in either of two ways, which go in opposite directions as briefly described below:

- *Positive effect.* Higher density is expected to contribute to a better utilisation of resources and to more effective exploitation of economies of scale (up to the point when resources become fully utilised). This is similar to the “density effect” argument described in the table above.
- *Negative effect.* Higher structural complexity entails higher ATCO workload and more sophisticated ATM systems and tools for the same volume of traffic. Traffic complexity can influence either costs or quality of service, depending on an ANSP’s response to it.

Variability in traffic demand is another important factor in comparative ATM performance. If traffic is highly variable, resources may be underutilised, or made available when there is little demand for them – this is termed “allocative inefficiency”. Variability in traffic demand is therefore likely to have an impact on productivity, cost-effectiveness, quality of service and predictability of

operations. It is broadly recognised that the different types of variability in traffic demand can be characterized as follows:

- *Seasonal variability* – the difference in traffic levels between different times of the year.
- *Within-week variability* – the difference in traffic levels between different days of the week.
- *Hourly variability* – the variation of traffic through the day.
- *Spatial variability* – variability within the ANSP airspace (e.g., variability in the tracks across the North Atlantic, caused principally by weather variation).

Conceptually, an index of traffic variability could be developed to capture each types of variability. Different types of variability require different types of management practices, processes, and training to ensure that an ANSP can operate flexibly in the face of variable traffic demand. Largely, variability can be statistically predictable, and therefore adequate measures to mitigate the impact of variability could in principle be planned (for example, overtime, flexibility in breaks, and flexibility to extend/reduce shift length). When the degree of unpredictable variation, either temporal or spatial, is significant, additional flexibility might be required, with a clear trade-off between costs and quality of service. Seasonal variability is particularly difficult for an ANSP to adapt to as working practices that are practically feasible have only a limited ability to deal with high seasonal variability. A useful indicator of differences in seasonal variability is the ratio of traffic in the peak week to the average weekly traffic.

The output measures for ANS provision are, for en-route, the en-route flight-hours controlled and, for terminal ANS, the number of IFR airport movements controlled. In addition to those output metrics, it is important to consider a "gate-to-gate" perspective, because the boundaries used to allocate costs between en-route and terminal ANS vary between ANSPs and might introduce a bias in the cost-effectiveness analysis. For this reason, an indicator combining the two separate output measures for en-route and terminal ANS provision has been calculated. Although the composite gate-to-gate output metric does not fully reflect all aspects of the complexity of the services provided, it is nevertheless the best metric currently available for the analysis of gate-to-gate cost-effectiveness. An assessment of the overall performance of an ANSP should take into account all the areas related to the economics of ANS – not only financial cost-effectiveness but also the quality of service provided, such as efficient routings and adequate levels of ATC capacity, while ensuring ANS safety. The quality of service provided by ANSPs has an impact on the efficiency of aircraft operations, which carry with them additional costs that need to be taken into consideration for a full economic assessment of ANSP performance.

In order to investigate a relationship between exogenous and endogenous factors and ANSPs' performance indicators a correlation analysis (Pearson's correlation coefficient) has been applied. Pearson's correlation coefficient is the test statistics that measures the statistical relationship, or

association, between two continuous variables. It is known as the best method of measuring the association between variables of interest because it is based on the method of covariance. It gives information about the magnitude of the association, or correlation, as well as the direction of the relationship. Figure 20 presents the interpretation of Pearson's correlation coefficient.

A perfect negative linear relationship	A strong negative linear relationship	A moderate negative relationship	A weak negative linear relationship	A very weak negative linear relationship	No linear relationship	A very weak positive linear relationship	A weak positive linear relationship	A moderate positive relationship	A strong positive linear relationship	A perfect positive linear relationship
-1	(-1; -0,7]	(-0,7; -0,5]	(-0,5; -0,3]	(-0,3; 0)	0	(0; 0,3)	[0,3; 0,5)	[0,5; 0,7)	[0,7; 1)	1
										

Figure 20. Interpretation of Pearson's correlation coefficient

Source: compiled by author

Investigation of an impact of exogenous and endogenous factors on ANSPs' performance was examined by applying a panel regression model (1):

$$Y_{i,t} = \alpha + \beta_{i,t} X'_{i,t} + \delta_i + \gamma_t + \varepsilon_{i,t}, \quad \varepsilon_{i,t} \sim WN(0, \Sigma_\varepsilon) \quad (1)$$

where $Y_{i,t}$ is dependent variable characterizing ANSPs' performance (En-route determined unit rate (EDUR), ATCO-hour productivity (ATCOHP), ATCO employment costs per ATCO-hour (ATCOEC), Financial gate-to-gate cost-effectiveness (FGTGCE), Support staff ratio (SSR)), $X'_{i,t}$ is a k -vector of regressors, and $\varepsilon_{i,t}$ are the error terms for $i = 1, 2, K, M$ cross-sectional units (countries) observed for dated periods $t = 1, 2, K, T$. The α parameter represents the overall constant in the model, while the δ_i and γ_t represent cross-section and period effects. Transformation of all variables (except real GDP growth and inflation) has been performed by using chain index⁸.

The Hausman test has been used to choose between fixed effects model or a random effects model. Panel Least Squares method has been used for estimation of estimators in the panel regression models. Robustness check has been performed by using different dependent variables in the panel regression models.

The major focus of the conceptual model is to examine and analyse the impact of ANSP's indolent in FAB activity on its performance. The proposed model should be seen as an instrument

⁸ Chain index is an index number in which the value of any given period is related to the value of its immediately preceding period (resulting in an index for the given period expressed against the preceding period = 100). This index type is called a chain index because individual indices with previous period = 100 can be chained together by multiplying (and dividing by 100) all consecutive indices, thus converting them into a series of indices with the first reference period = 100. This way, the consecutive values of the index numbers form a chain, as it were, from the first (reference) to the last period.

contributing to establish a better understanding of differences in ANSPs performance. Figure 14 illustrates the important distinction between exogenous and endogenous influences on ANSP performance. Exogenous factors are those outside the control of an ANSP, while endogenous factors are those entirely under the ANSP's control.

The dataset covers annual operational and financial data for 37 ANSPs providing en-route services in 41 ECAC Member States⁹ for a time period from 2005 to 2015 (total number of observations is 407). A list of ANSPs included in data sample is presented in Annex 3. ANSPs operating in ECAC Member States and providing only approach control services are out of scope of this data sample. Description of exogenous and endogenous factors potentially affecting the ANSPs' performance is provided in Annex 4. Statistical data used in the research is provided in Annex 5.

⁹Albania, Armenia, Austria, Belgium, Bulgaria, Bosnia and Herzegovina, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Moldova, Monaco, Montenegro, Netherlands, Norway, Poland, Portugal, Romania, San-Marino, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, The Former Yugoslav Republic of Macedonia, Turkey, Ukraine, United Kingdom. ANSPs providing services over other countries (DSNA over Monaco, ENAV over San Marino, MUAC over Luxembourg, Croatia Control and SMATSA over Bosnia and Herzegovina, SMATSA over Montenegro).

2. RESEARCH ON IMPACT OF ANSPs' INVOLVEMENT IN DIFFERENT PARTNERSHIPS ON THEIR PERFORMANCE

2.1. NETWORKING ANALYSIS OF ANSPs' INVOLVEMENT IN DIFFERENT PARTNERSHIPS

FABs and inter-FAB cooperation. Air traffic management in the European Union is still largely organised in a fragmented way, mostly according to national boundaries. This fragmentation limits capacity, adds to cost and, above all, can potentially affect safety. The key to improved capacity and efficiency, enhanced safety and lower costs for air navigation services is through enhanced cooperation and integration across borders. The establishment of functional airspace blocks (FABs)¹⁰ was aimed at fostering increased cooperation between and the integration of air navigation service providers, irrespective of national borders. The FAB concept was expounded in the first legislative package of the Single European Sky (SES I) as a principal means for reducing airspace fragmentation. The second legislative package (SES II) tackled the creation of FABs in terms of air navigation services provision, in addition to the airspace organisation issues. Nine FAB initiatives have been established to date (see Figures 21-22).

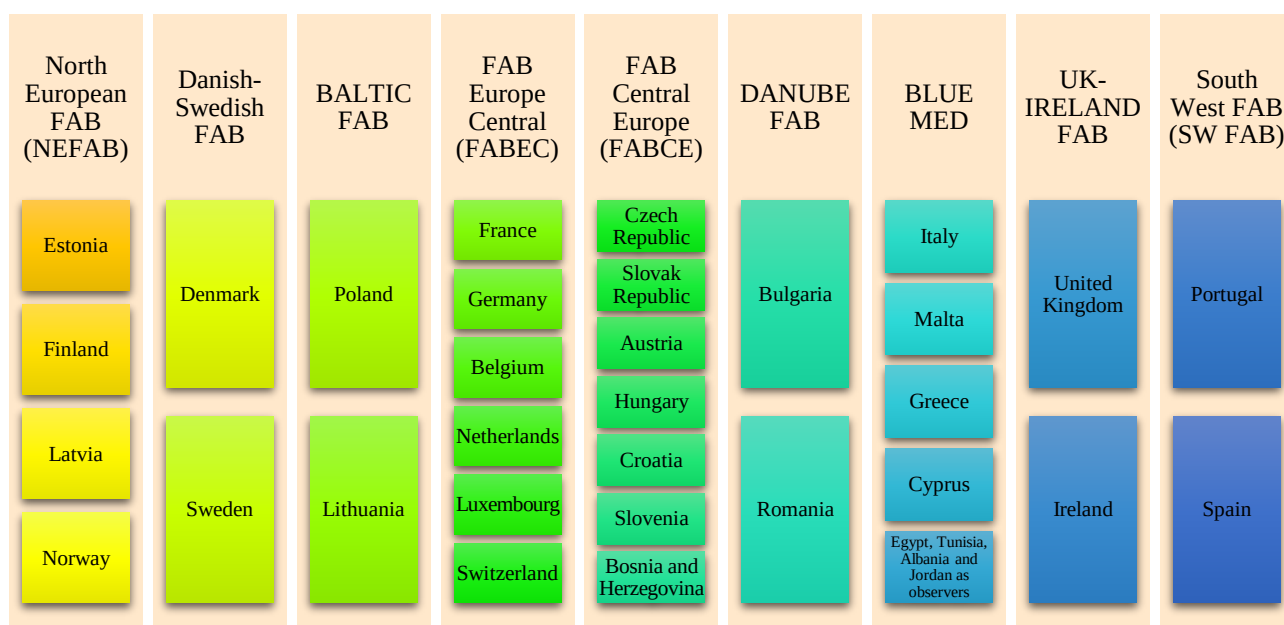


Figure 21. Nine FAB initiatives in Europe

Source: compiled by author

¹⁰ A Functional Airspace Block (FAB) is defined in the Single European Sky legislative package, namely Regulation (EC) No. 1070/2009 amending Regulation (EC) No. 549/2004, as an airspace block based on operational requirements and established regardless of State boundaries, where the provision of air navigation services and related functions is optimised through enhanced cooperation among air navigation service providers or, when appropriate, an integrated provider, always in a performance-driven perspective.

North European FAB (NEFAB)	EANS, Finavia, LGS, Avinor (Continental)
Danish-Swedish FAB	NAVIAIR, LFV
BALTIC FAB	Oro navigacija, PANSO
FAB Europe Central (FABEC)	Belgocontrol, DSNA, DFS, LVNL, Skyguide, MUAC
FAB Central Europe (FABCE)	Austro Control, Croatia Control, ANS CR, HungaroControl, LPS, Slovenia Control
DANUBE FAB	BULATSA, ROMATSA
BLUE MED	DCAC Cyprus, HCAA, ENAV, MATS
UK- IRELAND FAB	IAA, NATS
South West FAB (SW FAB)	NAV Portugal (Continental), ENAIRE

Figure 22. List of ANSPs involved in nine FAB initiatives in Europe

Source: adopted from Integra, 2017

Now only one Inter-FAB initiative has its clear scope, description goals, and even funding – BOREALIS. Goals (common value and political) of this alliance are:

- To facilitate cooperation between the Members, for the benefits of our customers, on commercially-recognized business partnering principles, that will make a contribution to the operational and financial performance of Members' air traffic services, and the achievement of Single European Sky and ICAO performance targets;
- To enable Members collectively to be more influential with relevant trade, regulatory and policy bodies in Europe and internationally by developing a common position on major issues and expressing it jointly.

The Borealis Alliance has been awarded considerable financial support to continue its work to deliver Free Route Airspace across Northern Europe by 2021. Borealis progress shown in Figure 23.

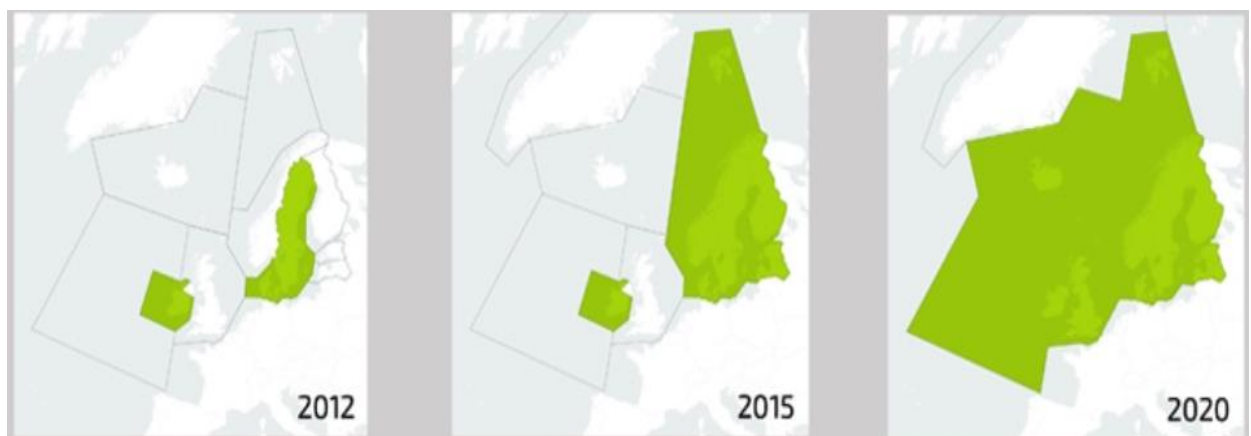


Figure 23. Borealis FRA project progress

Source: Borealis website <https://www.nefab.eu/news/view/44>

The programme involving all nine Borealis Members build on Free Route Airspace initiatives in three Functional Airspace Blocks – the Danish-Swedish, UK-Ireland and NEFAB – and Iceland (see Figure 24). By 2021, it will create seamless Free Route Airspace enabling airlines to plan and fly their preferred routes across the whole of Northern Europe, saving significant time, fuel and therefore money. It means this initiative when accomplished will increase performance of those ANSPs directly in Environment KPA, and indirectly in Safety, Capacity and Cost-efficiency KPAs KPIs.

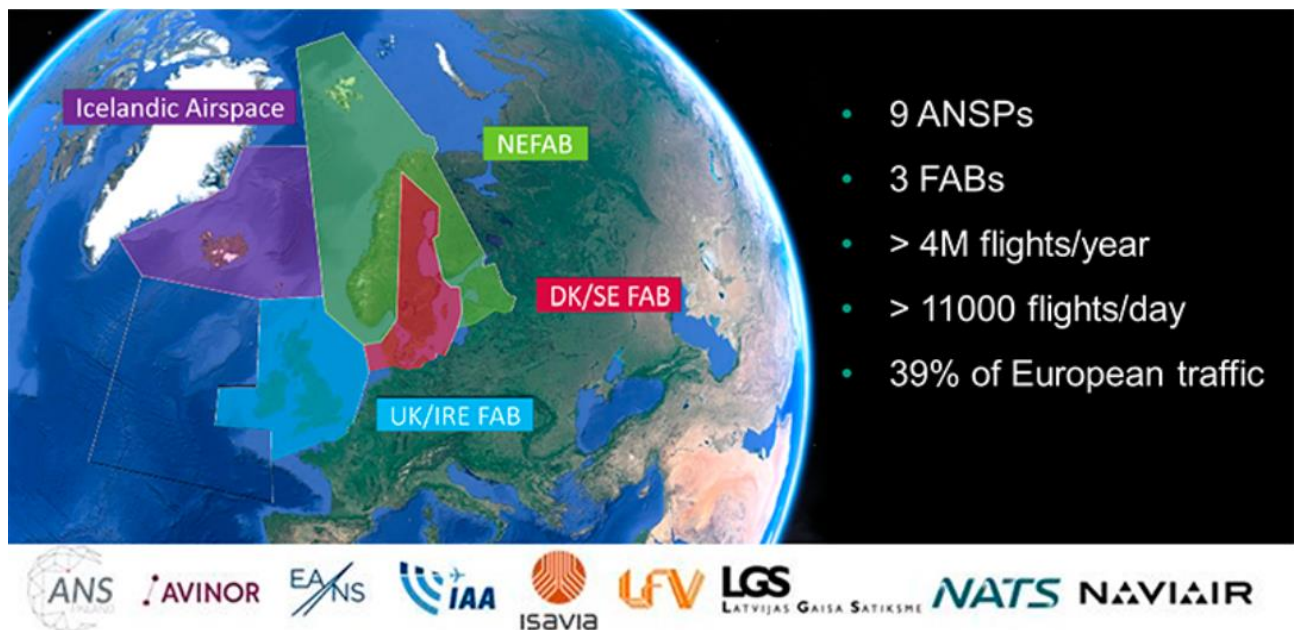


Figure 24. Composition and main statistics of Borealis

Source: Borealis website <http://www.borealis.aero/Members.23.aspx>

The Inter-FAB cooperation merge two partnership approaches bottom-up and top-down. Top-down – in establishment and managing the FABs, bottom-up in showing initiative in implementation of managerial and technological innovations seeking for better performance of participating FABs / ANSPs and bringing added value to airspace users. Other two factors, that it is more bottom up, than top-down initiative is desire to increase its political importance and value, second is to cover part of implementation expenses via European structural funds. The funding of €63.2 million has been granted to support the ongoing evolution of the Borealis Free Route Airspace programme, extending the number of countries in which Free Route Airspace is available and joining those areas of Free Route Airspace together.

Public-Private Partnership is widely used in ANS world. In Europe there are known two examples of ANSPs participation in PPP, one is SESAR Joint Undertaking (SJU), second one in United Kingdom's ANSP NATS (National Air Traffic Services). The SJU is a non-profit entity, which shall devote all its resources to the management of a public research programme of European

interest. The aim of the Joint Undertaking shall be to ensure the modernisation of the European air traffic management system by coordinating and concentrating all relevant research and development efforts in the Community. It shall be responsible for the execution of the ATM Master Plan and in particular for ensuring the involvement of the stakeholders of the air traffic management sector in Europe, in particular: air navigation service providers, airspace users, professional staff associations, airports, and manufacturing industry; as well as the relevant scientific institutions or the relevant scientific community (COUNCIL REGULATION (EC) No 219/2007; P. Ravenhill, T. Bolic, 2017a; 2017b).

SJU managing SESAR project, which now comprises from two programmes SESAR1 (2011-2016) and SESAR2020 (2016-2021). Partners of those programmes with managerial role of SJU are ANSPs, ANSPs consortias, technological alliances (COOPANS), airports alliances (SEAC2020), ground equipment manufacturers (INDRA, THALES, LEONARDO etc.), airborne manufacturers (AIRBUS, DASSAULT), manufactures consortias, ANSPs and ground equipment manufacturer’s consortias, research organizations, international organisations. Principal SJU PPP organisation shown in Figure 25 (P. Ravenhill, T. Bolic, 2017a; 2017b).

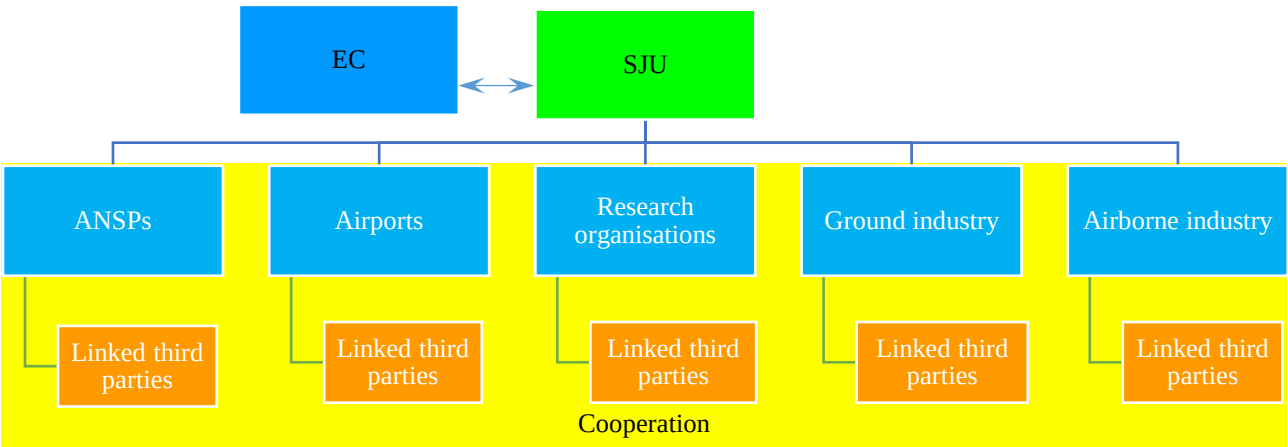


Figure 25. Principal SJU PPP organisation

Source: compiled by author

By European Commission, SESAR is an essential component of the Single European Sky initiative and a top priority of the Aviation Strategy for Europe, the project has pioneered new ways of working together between industry and institutions. Indeed, results coming out of the SESAR partnership are already prompting uptake by all stakeholders across Europe and worldwide. This is providing better connectivity and mobility, safety and security, a better passenger experience, as well as meeting wider social and environmental expectations to further decarbonise our economy. The development and implementation of the solutions are also generating more jobs and growth for Europe.

Overall evaluation of already closed SESAR1 programme by participants and assessors from managerial and results achieved perspective are positive. However, three main recommendations issued (see Figure 26).



Figure 26. Main recommendations for SESAR 2020

Source: compiled by author

One additional recommendation was -to strengthen inputs from The Performance Review Body (PRB) on current performance and performance short falls. That means full alignment between planning, industrial research, deployment and service provision performance monitoring should be ensured. Otherwise participants, and in particular ANSPs will not gain full scope of benefits from participation in such activities.

Alliances and consortias. *ANSP – ANSP cooperation.* In recent years, the cooperation between ANSPs became more intensive because of the obligation to create and implement FABs or intentions to expand business on an international scale or to diversificate its activities. ANSP-ANSP cooperation on international dimension takes several forms.

Cooperation to influence decision makers at EU level and participation in European ATM modernisation project covering industrial research (A6 alliance, B4, Gate One, etc.). While the FABs are primarily focused on operational performance improvement, the A6 Alliance (alliance of main European ANSPs) is focused on SESAR development and deployment, SESAR deployment execution (planning, governance, funding), and key strategic areas of A6 common interest related to transport and aviation legislation. During 2008–2013 almost 2.1 billion euro was assigned to SESAR1 programme and for period 2016-2022 for SESAR2020 programme about 1,4 billion euro. A6 alliance is the major partner of SESAR JU by providing leadership at a European level in critical technical and strategic areas (see Figure 27).

The A6 alliance was founded in 2011 by the six ANSP members of the SESAR JU – DFS (Germany), DSNA (France), ENAIRE (Spain), ENAV (Italy), NATS (UK) and NORACON¹¹ – a consortium including Austro Control (Austria), AVINOR (Norway), EANS (Estonia), Finavia (Finland), IAA (Ireland), LFV (Sweden) and Naviar (Denmark). In 2015 PANSA (Poland) became

¹¹ The COOPANS Alliance now represents Noracon members Austro Control, IAA, LFV and Naviar within the A6 Alliance. At the end of 2016 Noracon will no longer be a member of the A6 Alliance which means that Avinor, EANS and Finavia will no longer be involved.

a full member of the A6 Alliance, together with the COOPANS Alliance for work associated with Deployment Manager and SESAR 2020; and the B4 Consortium for work associated with SESAR 2020. The A6 Alliance has also reached a collaboration agreement with Skyguide in relation to SESAR 2020 R&D activities. Seven of Europe's nine Functional Airspace Blocks (FABs) – the geographic pillar of SES – are now represented within the A6 Alliance and our members are responsible for the safe management of more than 80% of Europe's air traffic, and more than 70% of the investment in the future European ATM infrastructure.

While the FABs are primarily focused on operational performance improvement, the A6 Alliance is focused on SESAR development and deployment, SESAR deployment execution (planning, governance, funding), and key strategic areas of A6 common interest related to transport and aviation legislation (see Figure 27).



Figure 27. A6 Alliance members and cooperating partners

Source: <https://www.a6alliance.net/about/>

The A6 seeks to maximise synergies between the ANSP members of the A6 Alliance to deliver customer and network benefits; and to provide leadership at a European level in critical technical and strategic areas. The A6 is an inclusive initiative for ANSP contribution to modernising the European ATM system and welcomes interest and input from non-A6 members.

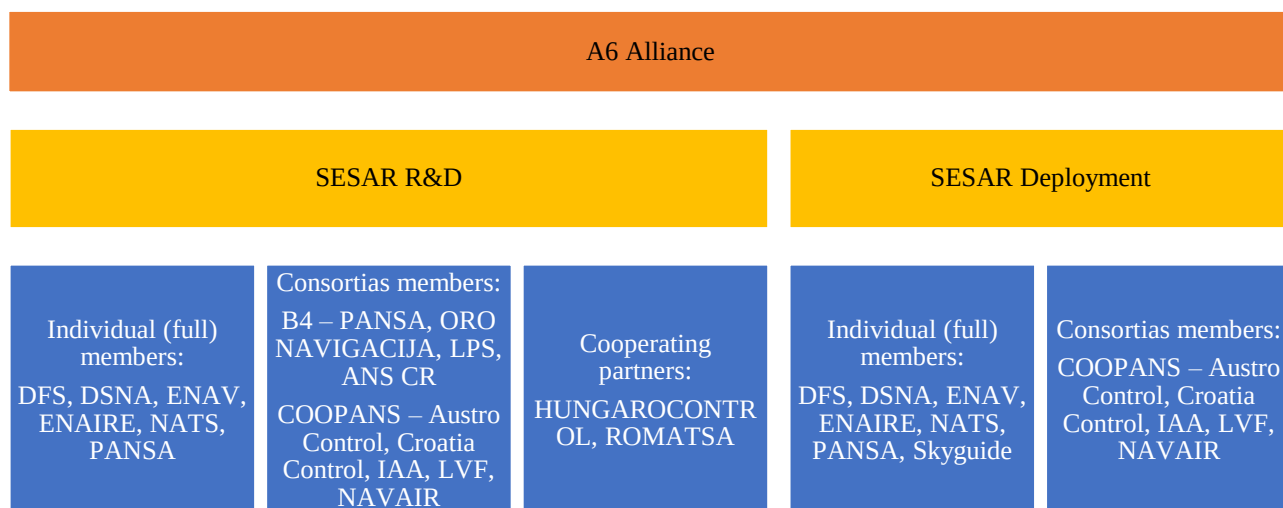


Figure 28. The main areas of A6 Alliance activities

Source: compiled by author

Gate One –cooperation platform of ANSPs of Central and Eastern European region, covering the entire area of three FABs and neighbouring countries ANSPs (Serbia, Bosnia and Herzegovina, and Macedonia). The aim is to promote the efficiency of European ATC through an enhanced cooperation among the participating ANSPs, to ensure a more powerful and coordinated advocacy of the countries of the region in the European decision-making processes.

In general, the main areas of interest of these groupings are:

- Identifying and ensuring use of best practices across the grouping;
- Carrying out benchmarking activities as appropriate to promote best practices;
- Establishing a joint strategy for communications; and
- Creation of a coherent influencing strategy to ensure aligned lobbying via the appropriate parties.

Cooperation in support services. The most illustrative example is training school, a joint venture of Entry Point North: owned by Avinor, Swedish Limited Company (2006) formed by Avinor, IAA, Naviair and LFV; with subsidiaries in Hungary and Ireland.

Other examples are Group EAD, a provider of centralised aeronautical information services, founded by Spanish AENA, German DFS and Frequentis AG. Flight Calibration Services founded by Austro Control, Skyguide and DFS. NATS (USA) – the Data Communication Integrated Services formed with US partners.

Cooperation in the provision of air navigations services (FAB / Inter-FAB / Alliance). Traditionally neighbouring ACCs have quite extensive cooperation on operation level due to service nature. The creation of FABs is addressed to more integrated management of airspace in the FAB's airspace, however, new trends could be observed in the recent years. One of them the Borealis initiative, which was established by 9 ANSPs, in three Functional Airspace Blocks – the Danish-

Swedish, UK-Ireland and NEFAB – and Iceland, to explore the potential for commercial economies of scale. Borealis aiming to establish a coordinated approach to the implementation of data link infrastructure in the region, also developing programme to deliver seamless and integrated Free Route Airspace across the whole of Northern Europe by 2021. In 2016, the funding of €63.2 million, through CEF2015¹² call has been granted to support the ongoing evolution of the Borealis Free Route Airspace programme, extending the number of countries in which Free Route Airspace is available and joining those areas of Free Route Airspace together.

Second example of cooperation in the provision of air navigations services is Nordic Unified Air Traffic Control (NUAC). NUAC is the first and until now only one integrated company to deliver ATM/CNS services for en-route in common airspace of DK-SE FAB. Swedish Legal Entity (Partnership) established in 2009. 50/50 owned by LFV and Naviair. 2012 NUAC certified to deliver Air Traffic Services in Danish/Swedish airspace –on behalf of LFV and Naviair, NUAC is responsible for the daily En Route operations and is responsible for the ACC in Copenhagen, Malmö and Stockholm. NUAC employs 14 employees and has 655 full time employees seconded from LFV and Naviair. It generates 70% of LFV's business revenues and 80% of Naviair's business revenues.

Cooperation in technology development (industrial partnership). In the recent decade, some ANSPs established industrial partnerships with their ATC system suppliers to commonly develop and procure a partially standardized system (e.g. COOPANS, ITEC, 4-Flight). The cooperation contributes to the standardization and reduction of infrastructure procurement and operational cost by sharing some ATM infrastructure, sharing maintenance teams or subcontracting maintenance support to ATM systems suppliers. On Figure 29, Approach to Technology in ECAC area, you could see Flight Data Processing Systems variations from country to country and Industrial partnership clusters.

iTEC (2001) alliance, formed by DFS (Germany), ENAIRE (Spain) and NATS (UK). This cooperation is done as a contractual cooperation, with aeronautical equipment producer INDRA as the contractor. Other ANSPs as LVNL (Netherlands), Avinor (Norway), PANSA (Poland) and SE „Oro navigacija“ joined the alliance respectively in 2011, 2016, and 2017. Cooperation under this alliance support flights in some of the most complex airspace in Europe: UK, Germany, Spain, the Netherlands, Norway, Lithuania and Poland. The main objective of the above-mentioned collaboration is creation of new generation ATM system features, 4D trajectory flight system, improved conflict detection tools, trajectory conformance monitoring and SWIM. From performance point of view, it will bring for participating ANSPs operational savings, system creation and maintenance cost savings (Cost-efficiency KPA), improved contingency (Safety KPA), effective Free route concept implementation (should improve Environment KPA), increase in airspace capacity under control (Capacity KPA). In addition, for their services customers, airspace users - routes with

¹² CEF – Connecting Europe Facility, mechanism to fund TEN-T projects.

optimal trajectories, means less fuel consumption and finally CO₂ emissions reduction (Environment KPA).

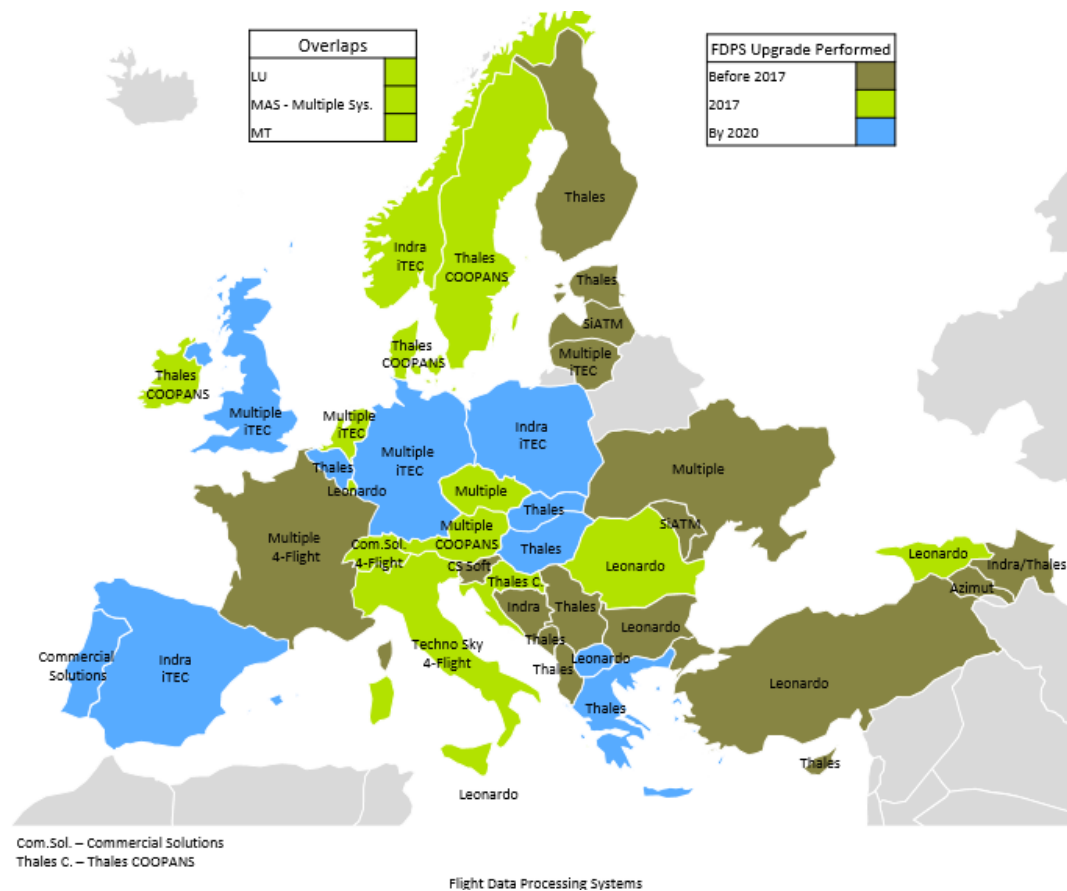


Figure 29. Approach to technology in ECAC area

Source: European Master Plan Level 3 Implementation Report 2016

Summarizing other partnership models in which participates ANSPs, it could be concluded, that they aimed at:

- have stronger voice on international scene, in liason with legal authorities, service or product suppliers;
- common umbrella for participation in tenders (industrial research, SESAR deployment, centralised services, etc.);
- application and sharing of best practices for synergy effect;
- to make impact on future planning;
- to achieve better financial performance;
- to achieve better environmental (shortest routes) performance;
- to diversificate the risks.

It should be noted, that cooperation between ANSPs and armed forces in all matters of air traffic management would be not tackled in this thesis.

In summary, the following partnerships forms are applied in Europe's ANS industry in which ANSPs are taking part (see Table 7).

Table 7. ANSPs partnerships existing now in Europe

Partnerships forms	Aim of partnership	Examples
Functional Airspace Blocks (FABs)	Airspace structure, Service provision and administrative procedures harmonisation	Active FABs presented in Table 2
Inter-FAB cooperation	Inter-FAB FRA concept implementation	BOREALIS
Public Private Partnership	Cooperation in industrial research projects Innovations implementation projects	SESAR Joint Undertaking (SJU) SESAR1 and SESAR2020 programmes NATS (UK)
Industrial partnership	Cooperation in creation of new ATM system Industrial research Improvement of service provision KPIs	COOPANS, iTEC, 4-Flight
Service provision partnership / Joint ventures	To provide services together (cost reduction) Centralised services provision	Nordic Unified Air Traffic Control (NUAC), European Aeronautical Database (EAD)
Alliances	To maximise synergies between the ANSPs; To deliver customer and network benefits; To provide leadership at a European level in critical technical and strategic areas Political - to be more influential with relevant trade, regulatory and policy bodies in Europe and to develop a common position on major issues and expressing it jointly	A6 BOREALIS
Consortias	Common participation in industrial research; Common participation in open calls (exp. Centralised services)	B4, SOFIA XL, FSP (HUNGAROCNTRON, Frequentis AG Ground Industry Austria Atos Belgium SA/NV etc.)
Initiatives	Enhanced cooperation among the participating ANSPs; Coordinated advocacy in the European decision-making processes	GATE ONE

In Table 7 presented partnership forms only with ANSPs representation, however other stakeholders of aviation sector also participating in various similar partnerships, with the very look like goals, like – AT-ONE (research organisations NLR and DLR), NATMIG (Sintef, AirTel ATN Ltd, SaaB AB – representatives of ground industry) (P. Ravenhill, T. Bolic, European Commission, 2017). Involvement in different forms of partnership of ANSPs and a year of beginning / becoming of participant of partnership are provided in Annex 6.

2.2. ANALYSIS OF FABs' PERFORMANCE IN EUROPE

The most significant increase in air traffic growth during 2005-2015 was observed in Baltic FAB and Danube FAB (see Figure 30). The variation in terms of traffic growth between FABs was to some extent driven by the shift of traffic flows due to geopolitical instability particularly in the South East quadrant of the European Region. Despite having one of the busiest third quarters on record in 2015, annual traffic levels remained 5% below the pre-recession levels of 2008 showing continued weakness in the air travel industry. The current geopolitical situation influences the actual route choices of airspace users, generating large traffic shifts in the European airspace, leading to important increases in traffic in some States and balancing out important decreases in others.

FABs	2005	2015	Change 2015/2005 (in percent)
Baltic FAB	524 445	913 391	74
BLUE MED FAB	2 320 388	2 699 867	16
Danish-Swedish FAB	1 276 686	1 349 351	6
Danube FAB	809 069	1 405 807	74
FAB CE	2 820 878	3 721 407	32
FABEC	8 988 386	9 769 172	9
North European FAB	994 500	1 269 740	28
South West FAB	2 020 590	2 234 815	11
UK-Ireland FAB	2 957 012	2 834 582	-4

Figure 30. Total IFR flights controlled by the FABs in 2005 and 2015

Source: calculated by author

In 2015, FAB CE and FABEC have the largest number of ANSPs involved in FAB activity (six Members) (see Figure 31).

FABs	Number of ANSPs involved in FAB activity	Number of ACC operational units in FAB	Number of APP operational units in FAB	Number of TWR operational units in FAB	Number of AFIS in FAB
Baltic FAB	2	2	8	18	0
BLUE MED FAB	4	7	45	37	27
Danish-Swedish FAB	2	3	27	28	2
Danube FAB	2	2	6	21	0
FAB CE	6	6	23	29	0
FABEC	6	14	39	107	54
North European FAB	4	6	26	37	38
South West FAB	2	6	21	28	0
UK-Ireland FAB	2	5	19	19	0

Figure 31. The main operational characteristics of FABs in Europe in 2015

Source: calculated by author

While the largest FAB in terms of number of ACCs, APPs, TWRs, and AFISs in FAB is FABEC. The largest controlled airspace by FAB's members in thousands km² was in South West FAB, while the total distance in charging area FAB (thousands of km) was in FABEC. FABEC Members (see Figure 32) provided the largest scope of operations in terms of provision of ANS (in terms of total flight-hours controlled by the ANSPs, total IFR airport movements controlled by the ANSPs, and composite flight-hours).

FABs	Controlled airspace by FAB (thousands km ²)	Total distance in charging area FAB (thousands of km)	Total flight-hours controlled by the ANSPs in FAB (thousands of flight hours)	IFR Airport movements controlled by the ANSPs in FAB (thousands of movements)	Composite flight-hours in FAB (thousands of flight hours)
Baltic FAB	409	913	457	379	558
BLUE MED FAB	1 674	2 700	1 732	1 731	2 195
Danish-Swedish FAB	785	1 349	635	810	851
Danube FAB	399	1 406	594	226	655
FAB CE	459	3 721	1 103	716	1 294
FABEC	1 822	9 769	4 754	5 188	6 141
North European FAB	1 310	1 270	617	1 013	888
South West FAB	2 861	2 235	1 624	1 623	2 058
UK-Ireland FAB	1 337	2 835	1 634	1 993	2 167

Figure 32. The main operational data of FABs in Europe in 2015

Source: calculated by author

In 2015, the largest en-route determined Members of Danish-Swedish FAB and FABEC (see Figure 33) set unit rates for AUs. The highest productivity in terms of ATCO-hour productivity was in FABEC and UK-Ireland FAB, while the lowest productivity in terms of support staff ratio and ATCO-hour productivity were in Baltic FAB, Danube FAB, and FAB CE. The highest cost level of provision of ATS (financial gate-to-gate cost-effectiveness and ATCO employment costs per ATCO-hour) was the highest in FABEC.

FABs	En route determined unit rate (DUR) (ER DUR [actual, €2009])	Support staff ratio	Financial gate-to-gate cost-effectiveness	ATCO employment costs per ATCO-hour	ATCO-hour productivity
Baltic FAB	37,96	3,57	0,39	0,07	0,69
BLUE MED FAB	37,27	2,61	0,35	0,06	0,79
Danish-Swedish FAB	59,65	2,56	0,36	0,10	0,84
Danube FAB	27,34	3,79	0,41	0,08	0,76
FAB CE	46,95	3,82	0,52	0,10	0,79
FABEC	63,39	3,32	0,61	0,16	1,05
North European FAB	35,70	2,81	0,31	0,07	0,83
South West FAB	46,54	2,62	0,42	0,14	0,91
UK-Ireland FAB	43,91	2,51	0,44	0,13	1,11

Figure 33. The main performance indicators of ANSPs in different FABs in 2015 (average values)

Source: calculated by author

2.3. ANALYSIS OF ANSPs' PERFORMANCE IN EUROPE

After the economic recession of 2009, which affected the aviation industry with an unprecedented -7% traffic decrease, 2010 was marked by a modest traffic recovery and the implementation of genuine cost containment measures by several ANSPs. In addition, for the ANSPs operating in SES States, the year 2012 marks the implementation of the SES performance and charging schemes, which introduced financial incentives for ANSPs. The most significant increase in air traffic growth was observed in Turkey and many Central and Eastern European countries. While the largest ANSPs experienced only a very moderate growth in air traffic flows ranging from 4 to 8 per cent (see Figure 34).

ANSPs/Country	2005	2015	Change 2015/2005 (in percent)	ANSPs/Country	2005	2015	Change 2015/2005 (in percent)
DHMI / TR	614 784	1 322 423	115	Avinor (Continental) / NO	486 066	604 635	24
BULATSA / BA	398 539	771 068	93	MUAC	1 450 200	1 702 263	17
Oro navigacija / LT	120 611	225 075	87	Austro Control / AT	831 441	915 007	10
MoldATSA / MD	25 883	45 440	76	DSNA / FR	2 655 494	2 887 215	9
Albcontrol / AL	116 040	201 983	74	LVNL / NL	540 145	585 439	8
PANSA / PL	403 834	688 316	70	LFV / SE	662 210	707 470	7
Croatia Control / HR	322 663	530 607	64	Belgocontrol / BE	553 945	591 480	7
LGS / LV	154 260	242 554	57	DFS / DE	2 651 315	2 818 110	6
EANS / EE	123 294	193 325	57	ENAV / IT	1 488 570	1 565 568	5
ROMATSA / RO	410 530	634 739	55	ENAIRES / ES	1 645 708	1 730 434	5
DCAC Cyprus / CY	208 490	319 091	53	NAVIAIR / DK	614 476	641 881	4
LPS / SK	317 703	467 466	47	IAA / IE	542 425	565 916	4
HungaroControl / HU	579 113	809 937	40	Skyguide / CH	1 137 287	1 184 665	4
Slovenia Control / SI	193 002	267 411	39	Finavia / FI	230 880	229 226	-1
M-NAV / MK	110 562	152 130	38	NATS (Continental) / UK	2 414 587	2 268 666	-6
MATS / MT	75 417	102 774	36	UkSATSE / UA	312 053	213 133	-32
NAV Portugal (Continental) / PT	374 882	504 381	35	SMATSA		601 283	
HCAA / GR	547 911	712 434	30	ARMATS / AM		42 168	
ANS CR / CZ	576 956	730 979	27				

Figure 34. Total IFR flights controlled by the ANSPs in 2005 and 2015

Source: calculated by author

The EU-wide cost-efficiency target is expressed in terms of en-route determined costs per service unit, and is computed at charging zone level. At EU-wide level, the en-route cost-efficiency target for RP2 corresponds to an annual average reduction of the determined unit cost of -3.3%. For ANSPs operating in SES States, the year 2015 marked the start of RP2. As in RP1, SES States/ANSPs operate under the determined costs method, which comprises specific risk-sharing arrangements aiming at incentivising ANSPs economic performance¹³. In 2018, almost all ANSPs operating in EU decreased en-route determined unit rates (see Figure 35). Actual en-route determined unit rates by ANSPs in 2018 are presented in Figure 36.

¹³ As part of the determined costs method, the costs planned for the reference period (RP) are set in advance and frozen for the length of the RP. If actual costs are lower than the determined costs, then the State/ANSP can keep the difference. On the contrary, if actual costs are higher than determined, then the State/ANSP has to bear a loss. This mechanism provides incentives for States/ANSPs to effectively control their costs and to flexibly adapt to unforeseen changes in traffic volumes.

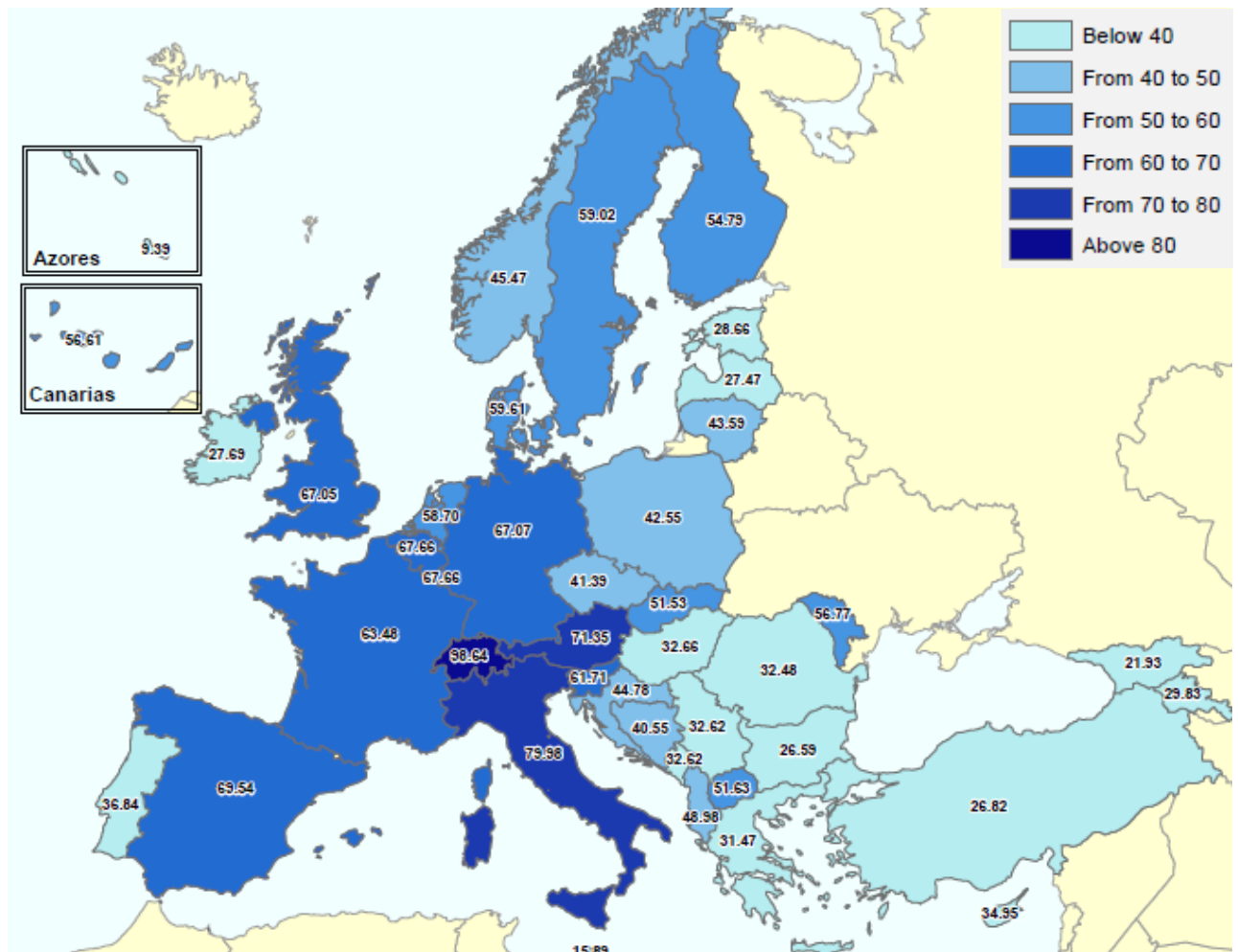


Figure 36. En-route determined unit rates by ANSPs in 2018

Source: Eurocontrol CRCO

Belgocontrol and LVNL are amongst the ANSPs with the highest unit costs, ranking second and third in Figure 37 below. It is noteworthy that although these two ANSPs operate in relatively similar operational (both exclusively provide ATC services in lower airspace) and economic conditions, the unit ATM/CNS provision costs of Belgocontrol have always been higher than those of LVNL in the past five years (+23% on average over 2005-2015). The gap has however significantly reduced in 2015 (+11%).

Figure 37 shows that between 2005 and 2015, ATM/CNS provision costs rose by +0.4% which is significantly less than the +1.4% increase in traffic. As a result, unit ATM/CNS provision costs per composite flight-hour decreased by -1.0% on average. Between 2005 and 2008, a period of sustained traffic growth, the number of composite flight hours rose faster (+3.8%) than ATM/CNS provision costs (+2.0%). As a result, unit ATM/CNS provision costs reduced by -1.8% over this period. This demonstrated the ability of the ATM industry to reduce unit costs in a context of robust and continuous traffic growth.

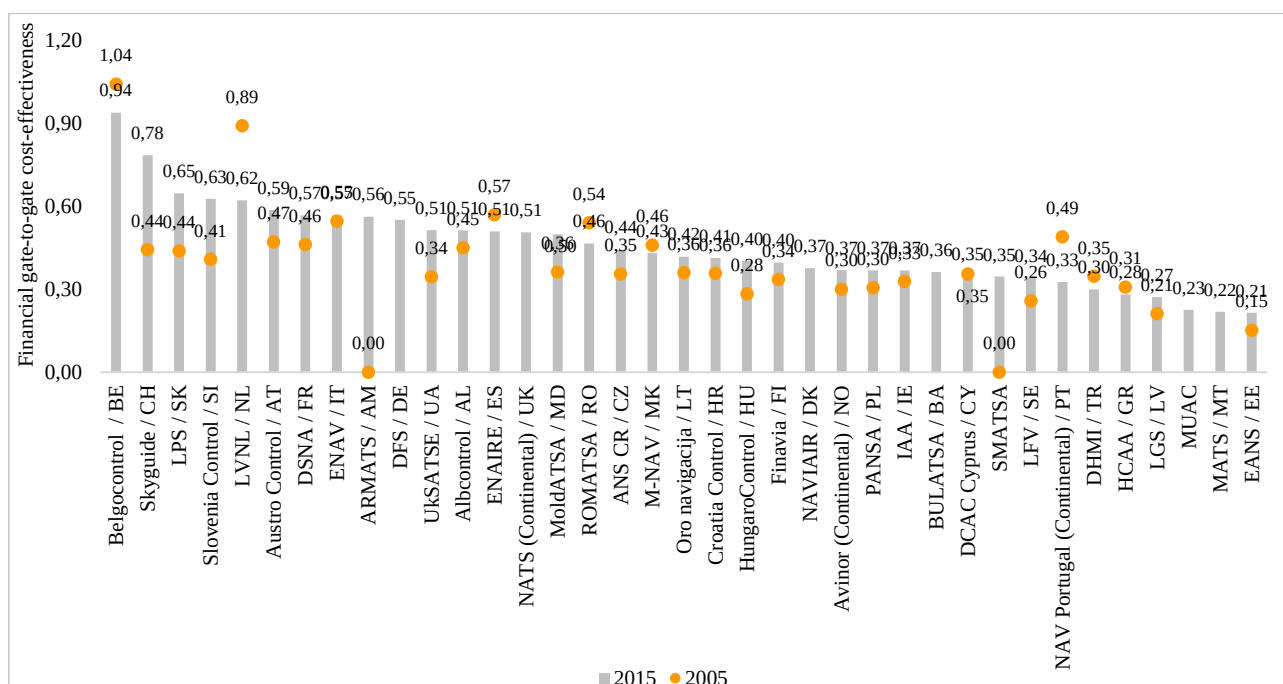


Figure 37. Financial gate-to-gate cost-effectiveness of ANSPs in 2005 and 2015

In 2009, following the economic recession traffic fell by -6.8%. In the meantime, ATM/CNS provision costs continued to grow by +1.4%. As a result, unit ATM/CNS provision costs increased by +8.8% and all the cost-effectiveness improvements achieved since 2005 were cancelled out. In 2010, ATM/CNS provision costs reduced by -4.6% in a context of a +2.0% increase in traffic. This performance improvement reflects the impact of the cost containment measures implemented by a majority of ANSPs in the wake of the sharp traffic decrease in 2009. Between 2010 and 2015, ATM/CNS provision costs remained constant in a context of relatively low traffic growth (+1.1% compared to +3.8% over the 2005-2008 period). As a result, unit ATM/CNS provision costs reduced by -1.1% between 2010 and 2015.

In 2015, ATM/CNS provision costs increased for 25 out of 37 ANSPs. Although 22 out of these 25 ANSPs experienced traffic increases in 2015, only nine could reduce unit costs. In 2015, ATM/CNS provision costs decreased for 12 out of 37 ANSPs compared to 2014. Two of these ANSPs experienced a sharp traffic decrease: UkSATSE (-36.1%) and MoldATSA (-9.1%). For UkSATSE, traffic significantly fell for the second year in a row (-36.1% in 2015 following a -36.8% decrease in 2014). These sharp traffic reductions mainly reflect the establishment of restricted/prohibited areas in UkSATSE airspace following the accident of Malaysia Airlines flight MH17 and military conflicts in the Eastern region of Ukraine. A new event negatively affecting the level of traffic in the last quarter of 2015 is that Russian airlines are not allowed anymore to operate to/from Ukrainian airports and to overfly the Ukrainian airspace. In an attempt to adjust to these unfavourable events, UkSATSE reduced its ATM/CNS provision costs by -39.7% mainly through a reduction in the number of staff

(-13.9%) and a very large decrease in non-staff operating costs (-49.9%). It is important to note that the large variations in costs expressed in real terms are affected by a high level of inflation in 2015 (+48.7%). When expressed in nominal terms, UkSATSE ATM/CNS provision costs are -10.3% lower than in 2014.

The traffic flows controlled by MoldATSA were also adversely affected (-9.1% compared to 2014) by the situation in Ukraine. Since ATM/CNS provision costs reduced by -27.2%, MoldATSA unit costs fell by -19.8% in 2015. The main driver for this decrease is a large reduction in staff costs (-38.1% in real terms).

Some ANSPs such as Belgocontrol (-7.4%) and MUAC (-7.0%) managed to substantially reduce ATM/CNS provision costs in a context of increasing traffic (+4.4% and +2.3%, respectively). For Belgocontrol, the lower costs (-€11.3M) mainly reflect substantial decreases in exceptional costs (-€4.7M) and non-staff operating costs (-€4.2M). For MUAC, the main driver for the observed decrease in ATM/CNS provision costs (-€10.2M) is a reduction of staff costs (-€11.2M).

On the other hand, it is noteworthy that ATM/CNS provision costs rose by more than +10.0% for two ANSPs: MATS (+16.2%) and BULATSA (+13.0%). In the case of MATS, the primary driver for the observed increase is higher staff costs (+28.1% or +€1.8M, mainly reflecting higher wages and salaries). A significant increase is also observed for the cost of capital (+28.9% or +€0.2M). The increase in MATS ATM/CNS provision costs should be seen in the context of a substantial traffic increase (+13.0%). For BULATSA, the higher ATM/CNS provision costs reflect increases in all cost categories: staff costs (+11.0% or +€5.9M), non-staff operating costs (+30.9% or +€2.5M), depreciation costs (+4.9% or +€0.4M) and the cost of capital (+15.5% or +€1.3M). As for MATS, the increase in BULATSA ATM/CNS provision costs should be seen in the context of a substantial traffic increase (+12.8%). As a result, unit ATM/CNS provision costs remained constant in 2015 (+0.2%).

Among the five largest ANSPs, DFS (-1.0%), ENAV (-2.5%) and ENAIRE18 (-3.8%) could achieve reductions in unit ATM/CNS provision costs in 2015. These reductions were achieved in the context of stagnating traffic for ENAV (-0.1%), and traffic increases for DFS (+0.8%) and ENAIRE (+1.9%). DFS ATM/CNS provision costs remained constant in 2015 (-0.2%). This average trend masks contrasting changes amongst the different cost categories. Indeed, higher staff costs (+5.9% or +€42.6M following an increase in pension costs) were compensated by the reporting of negative exceptional costs (-€1.3M while an amount of €47.0M was disclosed in 2014). These exceptional costs mainly include two elements: a) the IFRS (International Financial Reporting Standards) transition costs (€51.5M), and (b) a negative amount (-€50.0M) reflecting a contribution of the German State in DFS equity for the year 2015. It is understood that between 2015 and 2019, the German State will contribute for a total of €500M in order to strengthen DFS capital structure (€50M

in 2015 and €112.5M per year between 2016 and 2019). If the German State contribution to DFS equity would not be taken into account, then DFS unit ATM/CNS provision costs would amount to some €576 instead of €550. On the other hand, for DSN and NATS, ATM/CNS provision costs increased faster than traffic, leading to an increase in unit costs (+1.3% and +2.9%, respectively). For DSN, ATM/CNS provision costs rose by +2.7% (or +€32.7M) reflecting increases in all cost categories: staff costs (+2.5% or +€20.6M), non-staff operating costs (+3.0% or +€7.0M), depreciation costs (+2.1% or +€2.4M) and the cost of capital (+5.6% or +€2.7M). In the case of NATS, ATM/CNS provision costs rose by +4.8% (or +€41.1M) between 2014 and 2015. This reflects increases in all the cost categories (except the cost of capital): staff costs (+2.2% or +€11.2M), non-staff operating costs (+11.7% or +€17.2M), depreciation costs (+15.9% or +€19.6M). It should also be noted that in 2015, NATS reported exceptional costs (€8.7M) which were mainly relating to redundancy costs for Terminal ANS staff.

Key drivers for the financial cost-effectiveness performance include: a) ATCO-hour productivity (0.83 composite flight hours per ATCO-hour); b) ATCO employment costs per ATCO-hour (€112); and, c) support costs per unit output (€292). Around 31% of ATM/CNS provision costs directly relates to ATCOs in OPS employment costs while 69% relate to “support” functions including non-ATCOs in OPS employment costs, non-staff operating costs and capital-related costs such as depreciation costs and the cost of capital. Figure 37 shows that in 2015, ATCO employment costs per ATCO-hour (+1.8%) rose slightly faster than ATCO-hour productivity (+1.4%), and as a result ATCO employment costs per composite flight-hour increased by +0.5%. In the meantime, unit support costs fell by -1.9% since support costs remained close to 2014 levels (-0.3%) while the number of composite flight-hours increased (+1.7%). As a result, in 2015, unit ATM/CNS provision costs reduced by -1.2% at Pan-European system level. A detailed analysis of the changes in the key drivers of cost-effectiveness between 2005 and 2015 is provided hereafter.

In 2015, the ATCO-hour productivity of the Pan-European system as a whole amounted to 0.83 composite flight-hours per ATCO-hour. The ATCO-hour productivity in 2005 and 2015 for each ANSP is shown in Figure 38 below. Figure 38 shows that over the 2005-2015 period, improvements in ATCO-hour productivity were proportionally higher for ANSPs¹⁵ operating in Central and Eastern European States. Indeed, ATCO-hour productivity rose by +7.5% for these ANSPs since 2005. A very intense traffic growth (+57%) significantly contributed to the observed improvement for these ANSPs while the number of ATCO-hours on duty slightly increased by +0.9% on average. On the other hand, the productivity increase for ANSPs operating in Western European States is much lower (+1.0%). This mainly reflects the fact that, over the 2005-2015 period, traffic growth was much lower

¹⁵ Albcontrol, ANS CR, ARMATS, BULATSA, Croatia Control, DCAC Cyprus, DHMI, EANS, HungaroControl, LGS, LPS, MATS, M-NAV, MoldATSA, Oro Navigacija, PANSA, ROMATSA, Slovenia Control, SMATSA and UkSATSE.

for these ANSPs (+5%) while they could achieve reductions in ATCO-hours on duty (-0.7%). Therefore, the substantial gap in ATCO-hour productivity observed between the two ANSP groups in 2005 (36%) significantly reduced over the years to reach 24% in 2015. This result is an indication of the convergence in ATCO-hour productivity that took place since 2010 in the ATM industry.

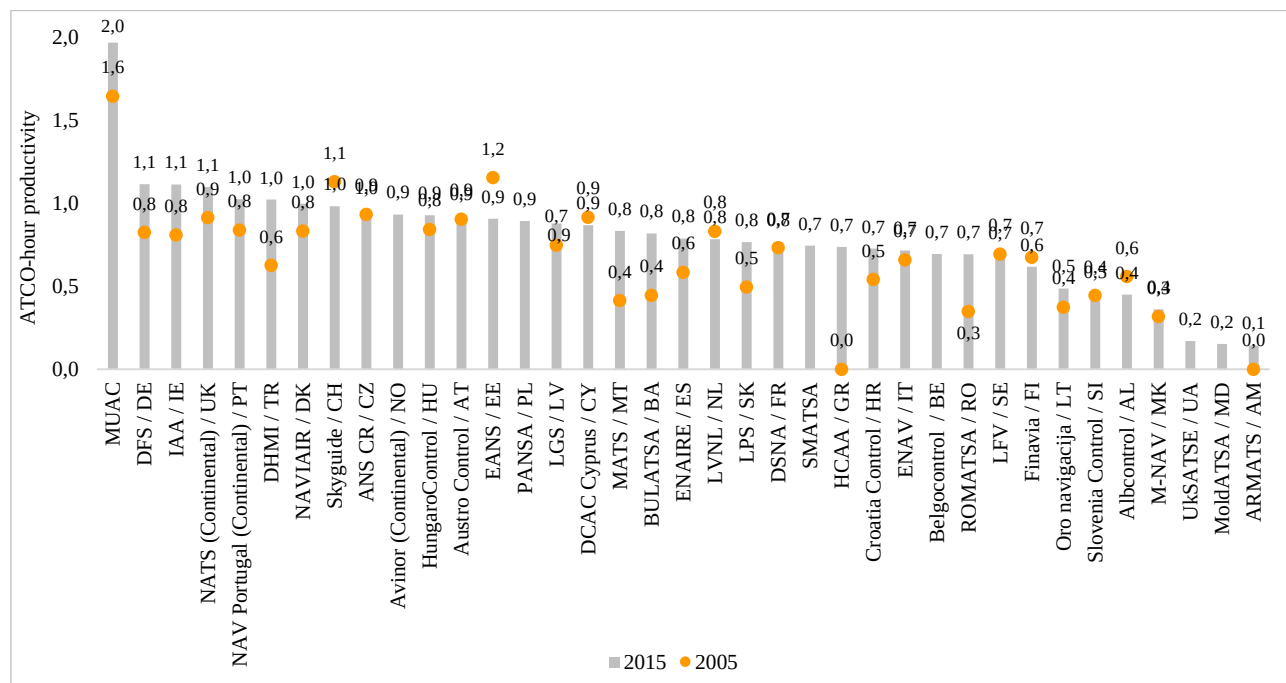


Figure 38. ATCO-hour productivity of ANSPs in 2005 and 2015

Source: calculated by author

At Pan-European system level, the increase in productivity achieved between 2014 and 2015 (+1.4%) is because traffic rose faster (+1.7%) than ATCO-hours on duty (+0.3%). This suggests that the largest increases in productivity are likely to arise from serving increased traffic with the same or a reduced number of ATCOs, although in some of the cases the number of ATCO-hours has risen, but not as fast as traffic growth. Changes in ATCOs in OPS hours on duty could arise from:

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

There is a wide range of ATCO-hour productivity among ANSPs. The ANSP with the highest ATCO-hour productivity in 2015 is MUAC (1.97), which only provides ATC services in upper airspace, while the ANSP with the lowest ATCO-hour productivity is ARMATS (0.14), i.e. one of the smallest ANSPs in terms of traffic volumes. Figure 38 also indicates that there are substantial

differences in ATCO-hour productivity even among the five largest ANSPs. Indeed, DFS ATCO-hour productivity (1.11) is +55.6% higher than that of ENAV (0.72). It is important to mention that significant gains in cost-effectiveness could be achieved if the European average productivity (0.83) was raised to the level of the top quartile. Most of the ANSPs that achieve or are close to top quartile ATCO-hour productivity (Austro Control, ANS CR, DFS, DHMI, MUAC, NATS and Skyguide) are among the ANSPs with the most complex traffic. On the other hand, ARMATS, MoldATSA and UkSATSE, which belong to the ANSPs with the least complex traffic, show an ATCO-hour productivity, which is lower than the bottom quartile. Low productivity in some of these ANSPs may be a consequence of their small size, and the difficulty in adapting their available ATC capacity and existing infrastructure to low traffic volumes and high seasonal variability. In the case of ARMATS, MoldATSA and UkSATSE, the sharp traffic decreases experienced in 2015 (-14.5%, -9.1% and -36.1%, respectively) had a massive adverse impact on ATCO productivity.

Figure 39 presents the trends of support staff ratio of ANSPs in 2005 and 2015. In general, these trends are very similar as in ATCO-hour productivity among ANSPs described above. In 2015, at Pan-European level, unit support costs fell by -1.9% since traffic rose by +1.7% while support costs remained close to their 2014 levels (-0.3%). Contrary to ATCO employment costs, support costs encompass a variety of cost items, which require specific analysis. There is a general acknowledgement that the Pan-European system has excessive support costs due to its high level of operational, organisational, technical and regulatory fragmentation.

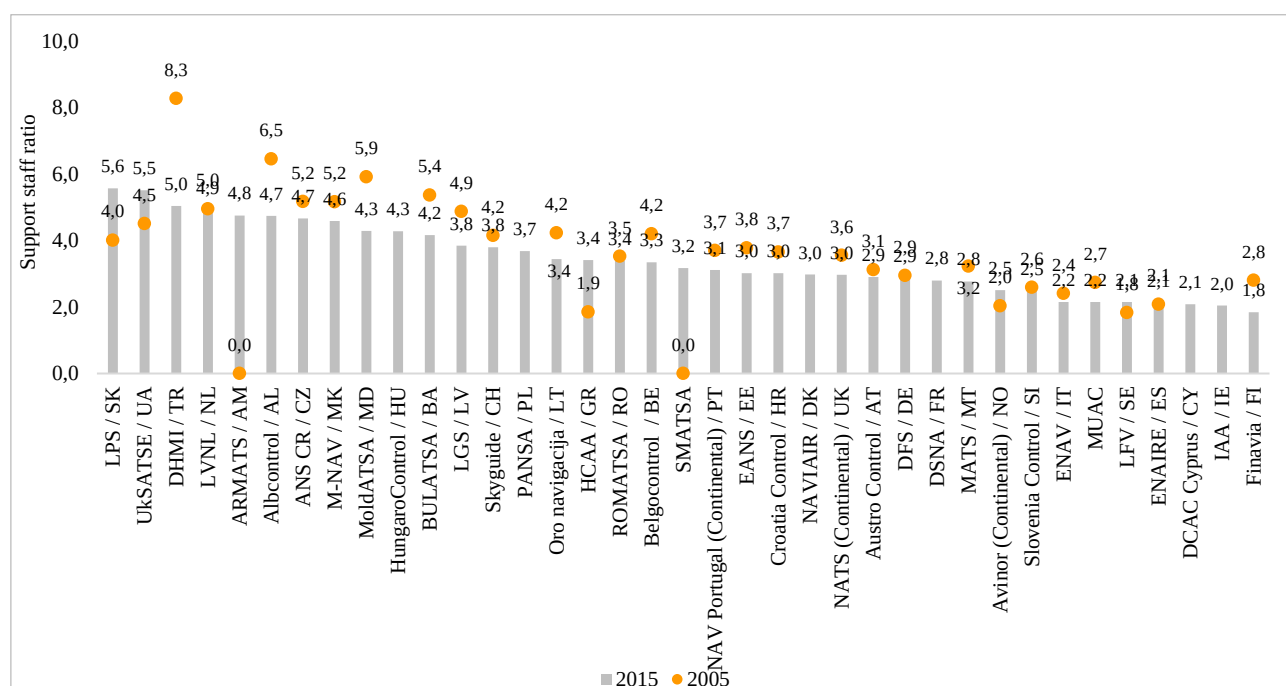


Figure 39. Support staff ratio of ANSPs in 2005 and 2015

Source: calculated by author

Improvements in ATCO-hour productivity and support staff ratio can result from more effective OPS room management and by making a better use of existing resources, for example through the adaptation of rosters (preferably individually-based to enhance flexibility) and shift times, effective management of overtime, and through the adaptation of sector opening times to traffic demand patterns. Similarly, advanced ATM system functionalities and procedures are drivers for productivity improvements. It is also expected that SES tools such as FABs, the Network Manager, the Performance Scheme and the technological pillar (SESAR) contribute to increase ATCO productivity by a significant factor while ensuring safety standards.

Figure 40 below shows that in 2015, ATCO employment costs per ATCO-hour (+1.8%) rose slightly faster than ATCO-hour productivity (+1.4%), and as a result ATCO employment costs per composite flight-hour increased by +0.5%. In the meantime, unit support costs fell by -1.9% since support costs remained close to 2014 levels (-0.3%) while the number of composite flight-hours increased (+1.7%). As a result, in 2015, unit ATM/CNS provision costs reduced by -1.2% at Pan-European system level.

At Pan-European system level, ATCO employment costs per ATCO-hour continuously rose between 2010 and 2015 (an average of +1.6%). As a result, in 2015 ATCO employment costs per ATCO-hour are +45% higher than in 2005. The increase in ATCO employment costs per ATCO-hour between 2014 and 2015 (+1.8%) reflects the fact that ATCO employment costs rose faster (+2.1%) than ATCO hours on duty (+0.3%).

In 2015, ATCO employment costs per ATCO-hour rose for 24 out of the 37 ANSPs. Increases larger than +15% were observed for three ANSPs: LFV (+22.5% from €86 to €105), LGS (+18.1% from €35 to €41) and MATS (+26.1% from €30 to €38). For MATS, the main driver for this substantial increase is the implementation of a new collective agreement in 2016. Among the five largest ANSPs, the most noticeable increases in ATCO employment costs per ATCO-hour in 2015 were observed for DFS (+14.7%, from €197 to €227) and NATS (+8.8%, from €148 to €161). For DFS, this increase mainly reflects higher employer contributions to pensions following a decrease in the discount rate in 2015. A smaller increase was observed for ENAV (+2.0%, from €112 to €115), while DSNA employment costs per ATCO-hour remained almost stable (+0.4% from €99 to €100) and those of ENAIRE fell by -3.1% (from €172 to €166). Because of these changes, the gap between DFS and DSNA in terms of employment costs per ATCO-hour further increased in 2015, reaching a factor of 2.3 (compared to 2.0 in 2014).

On the other hand, decreases in ATCO employment costs per ATCO-hour are observed for 13 ANSPs. In particular, reductions larger than -20% are observed for MoldATSA (-58.4% from €25 to €11), UkSATSE (-44.6%, from €22 to €12), DCAC Cyprus (-23.7%, from €66 to €50), and Avinor

(-22.2% from €120 to €94). The unit ATCO employment costs at Pan-European system level amounted to €112 per ATCO-hour in 2015.

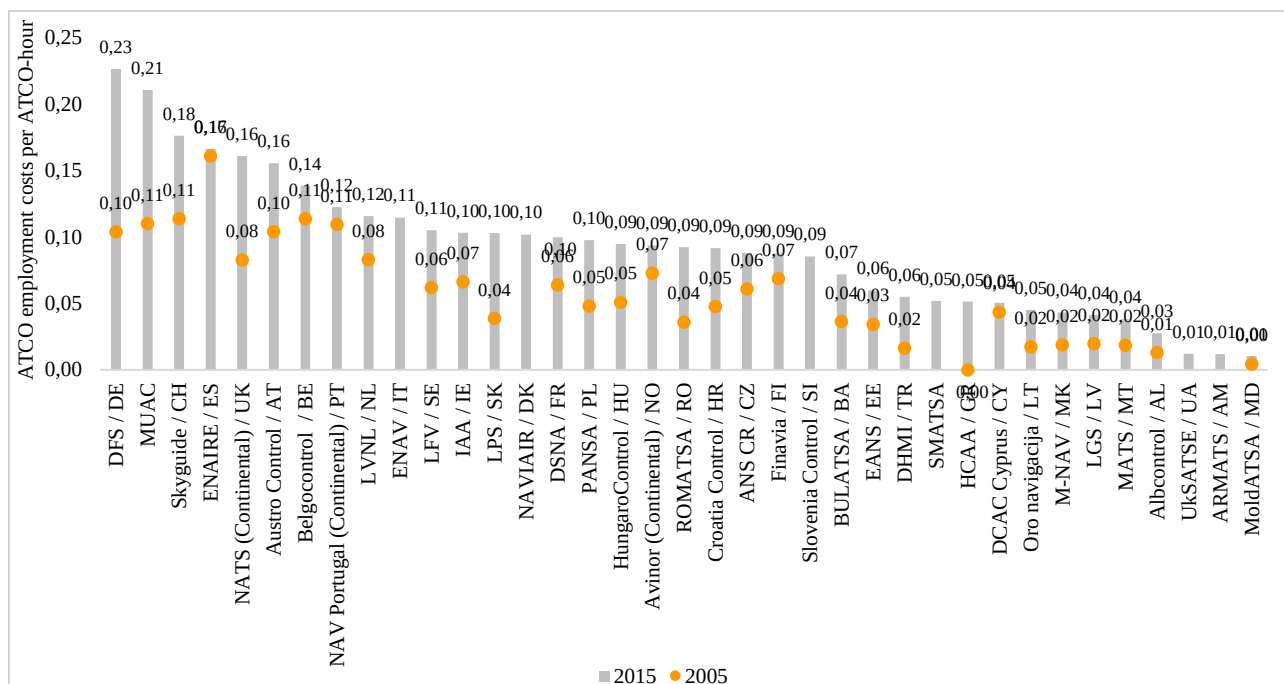


Figure 40. ATCO employment costs per ATCO-hour of ANSPs in 2005 and 2015

Source: calculated by author

Figure 40 shows the values for this indicator for all the ANSPs. There is a wide range of ATCO-hour employment costs across ANSPs, which is not surprising given the heterogeneity in the social and economic environments across Europe. In 2015, DFS ATCO employment costs per ATCO-hour (€227) are the highest in Europe, above MUAC (€211) and Skyguide (€176). A major exogenous factor that underlies differences in unit employment costs is the difference in prevailing market wage rates in the national economies in general. This is also associated with differences in the cost of living. To assess the influence of these exogenous differences, employment costs per ATCO-hour have also been examined in the context of Purchasing Power Parity (PPP). After PPP adjustment, the average unit employment costs per ATCO-hour amounts to €121 (compared to €112 without adjustment). For many Central and Eastern European ANSPs (e.g. ANS CR, BULATSA, Croatia Control, HungaroControl, LPS, PANSA and ROMATSA) the PPP adjustment brings the unit employment costs close or higher than those operating in Western Europe. Significant increases in ATCO employment costs per ATCO-hour are observed for ANSPs operating in Central and Eastern European countries and which started from a relatively low base in 2005. This illustrates the gradual convergence of employment costs in Central and Eastern European economies following the strengthening of the economic integration and enhanced labour mobility.

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

2.4. RESEARCH ON IMPACT OF INVOLVEMENT OF ANSP IN DIFFERENT PARTNERSHIPS ON ITS PERFORMANCE

Correlation analysis results suggest about a positive statistically significant relationship between ANSP performance ratios and indicators reflecting scope of operations (ANS) by ANSP (composite flight-hours, total flight-hours, and IFR airport movements controlled by the ANSP) (see Table 8 and Annex 7). While a negative statistically significant relationship between ATCO productivity and air traffic volatility was observed. In addition, a negative statistically significant relationship between traffic volatility and all ANSP's operational indicators is observed. However, the results of correlation analysis between other ANSP's performance indicators and ANSP's operational indicators as well air traffic indicators are diverse and not straightforward.

Results of correlation analysis indicate about a positive statistically significant relationship between involvement of ANSP in FAB activity and its performance indicators. However, a positive statistically significant relationship between a number of partnership and ANSP performance indicators is observed only in some cases. Therefore, the results of correlation analysis do not allow concluding about the causal relationship between involvements of ANSP in different partnerships on its performance.

Table 8. Determinants of ANSP's performance: correlation analysis results

Correlation Probability	ATCOEC	ATCOHP	EDUR	FGTGCE	SSR
ATC	0.381557	0.243604	-0.142318	0.067865	-0.095564
	0.0000	0.0000	0.0460	0.1761	0.0556
ATCOEC	1.000000	0.537327	0.012806	0.067865	-0.125655
	-----	0.0000	0.8582	0.1761	0.0120
ATCOHP	0.537327	1.000000	-0.432388	-0.123039	0.134163
	0.0000	-----	0.0000	0.0143	0.0073
ATD	0.330297	0.201511	-0.114351	0.036503	-0.087388
	0.0000	0.0001	0.1096	0.4672	0.0801
CFH	0.665074	0.548857	-0.267984	-0.113589	-0.244911
	0.0000	0.0000	0.0001	0.0233	0.0000
CPL	0.139891	0.112544	-0.088066	0.147440	-0.014797
	0.0089	0.0356	0.2185	0.0057	0.7821

Correlation Probability	ATCOEC	ATCOHP	EDUR	FGTGCE	SSR
EDUR			1.000000	0.370846	-0.132439
			-----	0.0000	0.0636
FAB	-0.339517	-0.163204	0.0000	-0.011656	0.091784
	0.0000	0.0011	1.0000	0.8165	0.0660
FAB_Y	0.399450	0.189768	-0.335328	-0.371816	-0.146807
	0.0000	0.0001	0.0000	0.0000	0.0032
FGTGCE	-0.057573	-0.123039	0.370846	1.000000	0.173344
	0.2530	0.0143	0.0000	-----	0.0005
FLANSP	-0.017912	0.005044	-0.178143	-0.046543	0.126598
	0.7666	0.9334	0.0139	0.4429	0.0352
IFRA	0.453915	0.319326	0.003729	-0.067666	-0.356433
	0.0000	0.0000	0.9585	0.1835	0.0000
IR	-0.142599	-0.015834	0.221342	0.182212	0.028893
	0.0113	0.7795	0.0018	0.0011	0.6077
OSANSP	0.090340	0.117539	-0.032131	-0.020942	0.086015
	0.0715	0.0188	0.6540	0.6766	0.0850
PART	-0.162980	-0.121141	0.232699	0.083071	0.042086
	0.0011	0.0155	0.0010	0.0975	0.4000
R_HDIF	0.342805	0.252104	-0.123063	0.038448	0.003573
	0.0000	0.0000	0.0849	0.4437	0.9431
R_SDIF	0.303490	0.375270	-0.125875	0.012331	-0.103435
	0.0000	0.0000	0.0780	0.8060	0.0382
R_VDIF	-0.054097	0.148238	-0.184813	0.003994	-0.019658
	0.2810	0.0030	0.0093	0.9366	0.6944
RGDP	0.071471	0.119085	-0.135909	-0.101257	-0.105877
	0.1828	0.0261	0.0569	0.0584	0.0472
SANSPR	0.073960	-0.002851	0.233813	-0.036603	-0.329302
	0.2030	0.9609	0.0009	0.5312	0.0000
SSR					1.000000

STC	0.267563	0.314284	-0.149067	0.038203	-0.029716
	0.0000	0.0000	0.0366	0.4467	0.5525
STF	-0.086939	-0.100060	0.040575	0.108198	0.543185
	0.0828	0.0458	0.5713	0.0307	0.0000
TFH	0.657644	0.559273	-0.292107	-0.104869	-0.198677
	0.0000	0.0000	0.0000	0.0363	0.0001
TVM	0.092969	-0.092210	-0.064861	-0.073895	-0.004927
	0.0636	0.0658	0.3652	0.1406	0.9216
TVW	0.105095	-0.023434	-0.051586	-0.093366	0.012799
	0.0359	0.6407	0.4716	0.0624	0.7981

Source: calculated by author

Ideally, since the 37 ANSPs operate in very diverse environments across Europe, all the factors affecting ANSP performance should be taken into account in making fair performance comparisons, especially since many of these factors are outside the direct control of ANSPs. However, due to the data limitation, the panel regression models consider only the most statistically significant determinants identified after correlation analysis.

Results of panel regression show a positive impact of an increase of operations provided by ANSP on its productivity (see Figures 41-42). The impact of size on ANSPs' performance is an important policy issue given the infrastructure characteristics of the ANS sector and the expectation that fixed costs can be more effectively exploited with larger amounts of traffic is confirmed. The

growth of scale of ANSP's operations increases ATCO employment costs per ATCO-hour and financial gate-to-gate cost of ANSP suggesting that ANSPs do not exploit the economy of scale to reduce the costs of provision of ANS and increase cost-effectiveness. This behaviour of ANSPs can be explained by full cost recovery policy applied in ANS provision industry. Comparative price level has a positive statistically significant impact on ANSP's performance indicators expressed in absolute values (ATCO employment costs per ATCO-hour) and ANSP's productivity (Financial gate-to-gate cost-effectiveness).

Dependent Variable: ATCOEC Method: Panel Least Squares Date: 08/01/18 Time: 17:14 Sample: 2005 2015 Periods included: 11 Cross-sections included: 32 Total panel (unbalanced) observations: 349					Dependent Variable: FGTGCE Method: Panel Least Squares Date: 08/01/18 Time: 17:14 Sample: 2005 2015 Periods included: 11 Cross-sections included: 32 Total panel (unbalanced) observations: 350				
Variable	Coefficient	Std. Error	t-Statistic	Prob.	Variable	Coefficient	Std. Error	t-Statistic	Prob.
ATC	-0.016883	0.030075	-0.561348	0.5750	ATC	0.051308	0.036997	1.386834	0.1665
CFH	1.619751	0.111396	14.54049	0.0000	CFH	-0.589979	0.137232	-4.299143	0.0000
CPL	0.337259	0.282611	1.193367	0.2336	CPL	0.903400	0.347407	2.600410	0.0098
RGDP	-0.008805	0.004202	-2.095181	0.0370	RGDP	-0.007030	0.005122	-1.372461	0.1709
TVM	0.785461	0.274125	2.865335	0.0044	TVM	-0.849748	0.338039	-2.513762	0.0124
C	-1.578508	0.405008	-3.897470	0.0001	C	1.546082	0.498330	3.102527	0.0021
Effects Specification					Effects Specification				
Cross-section fixed (dummy variables)					Cross-section fixed (dummy variables)				
R-squared	0.659302	Mean dependent var	1.419637		R-squared	0.225630	Mean dependent var	0.998292	
Adjusted R-squared	0.619991	S.D. dependent var	0.440548		Adjusted R-squared	0.136565	S.D. dependent var	0.359615	
S.E. of regression	0.271575	Akaike info criterion	0.330809		S.E. of regression	0.334159	Akaike info criterion	0.745299	
Sum squared resid	23.01094	Schwarz criterion	0.739513		Sum squared resid	34.95028	Schwarz criterion	1.153138	
Log likelihood	-20.72621	Hannan-Quinn criter.	0.493505		Log likelihood	-93.42732	Hannan-Quinn criter.	0.907633	
F-statistic	16.77133	Durbin-Watson stat	0.658462		F-statistic	2.533319	Durbin-Watson stat	2.585006	
Prob(F-statistic)	0.000000				Prob(F-statistic)	0.000010			

Figure 41. Determinants of ANSP's performance (cost-efficiency): panel regression results

Source: calculated by author

Dependent Variable: ATCOHP Method: Panel Least Squares Date: 08/01/18 Time: 17:14 Sample: 2005 2015 Periods included: 11 Cross-sections included: 32 Total panel (unbalanced) observations: 349					Dependent Variable: SSR Method: Panel Least Squares Date: 08/01/18 Time: 17:14 Sample: 2005 2015 Periods included: 11 Cross-sections included: 32 Total panel (balanced) observations: 352				
Variable	Coefficient	Std. Error	t-Statistic	Prob.	Variable	Coefficient	Std. Error	t-Statistic	Prob.
ATC	-0.010225	0.013004	-0.786329	0.4323	ATC	-0.006538	0.011865	-0.550996	0.5820
CFH	0.598339	0.048165	12.42282	0.0000	CFH	-0.190039	0.043960	-4.322977	0.0000
CPL	-0.011580	0.122193	-0.094765	0.9246	CPL	0.015334	0.111523	0.137499	0.8907
RGDP	0.002794	0.001817	1.537698	0.1251	RGDP	0.000721	0.001644	0.438341	0.6614
TVM	-0.046170	0.118524	-0.389540	0.6971	TVM	-0.212867	0.108286	-1.965782	0.0502
C	0.483309	0.175114	2.759961	0.0061	C	1.429983	0.159803	8.948423	0.0000
Effects Specification					Effects Specification				
Cross-section fixed (dummy variables)					Cross-section fixed (dummy variables)				
R-squared	0.735191	Mean dependent var	1.113018		R-squared	0.757812	Mean dependent var	1.002711	
Adjusted R-squared	0.704636	S.D. dependent var	0.216057		Adjusted R-squared	0.730133	S.D. dependent var	0.206591	
S.E. of regression	0.117422	Akaike info criterion	-1.346127		S.E. of regression	0.107321	Akaike info criterion	-1.526809	
Sum squared resid	4.301799	Schwarz criterion	-0.937423		Sum squared resid	3.628131	Schwarz criterion	-1.120689	
Log likelihood	271.8992	Hannan-Quinn criter.	-1.183431		Log likelihood	305.7184	Hannan-Quinn criter.	-1.365193	
F-statistic	24.06129	Durbin-Watson stat	0.593779		F-statistic	27.37893	Durbin-Watson stat	0.862889	
Prob(F-statistic)	0.000000				Prob(F-statistic)	0.000000			

Figure 42. Determinants of ANSP's performance (productivity): panel regression results

Source: calculated by author

Ideally, all the factors affecting ANSP performance should be taken into account in making fair performance comparisons, however, due to the data limitation it was impossible to assess the impact of involvement of ANSP in different partnerships on its performance using panel regression analysis.

3. RECOMMENDATIONS FOR MODIFICATION OF A CONCEPTUAL MODEL ACCORDING TO THE EMPIRICAL RESULTS

The following recommendations for modification of a conceptual model of impact of ANSP's involvement in partnerships on its performance are:

- A more comprehensive list of legal and socioeconomic conditions shall be included in the model (for instance, market wage rates, exchange rate volatility). The legal and socio-economic conditions prevailing in individual countries are affected by national policymakers at a more general level (for example taxation policy), or by national and international macro-economic conditions. Major examples include the prevailing national wage rates, and levels and systems of taxation.

- The operational conditions, such as the traffic patterns the ANSP has to deal with, are determined by decisions made by airports, airlines, and especially, flying travellers. Operational conditions undoubtedly have a direct impact on cost-effectiveness performance, although the extent and magnitude of the impact is not straightforward to isolate. In addition, the structure of the airspace controlled by ANSP could also affect ANS operational performance and cost-efficiency.

- The institutional and governance arrangements for ANS in a particular country are set in place by the policies and specific aviation laws of each country. These factors are exogenous to the ANSP but decision-making concerning some of them is largely driven by national aviation policy-makers. Some of these factors relate to international requirements such as those imposed by ICAO, EUROCONTROL and the Single European Sky. These policies at State and European level are subject to changes according to the strategic objectives for the sector. It is generally considered that institutional and governance arrangements will not affect ATM cost-effectiveness directly; rather they act as influences or constraints affecting endogenous factors (such as the overall business objectives, the internal organisation, and the operational setup between civil and military). Despite that fact, the institutional and governance arrangements could also affect ANSP's performance and could be included in the model.

- The organisational factors should also to be considered in the scope of a comprehensive analysis of the impact of ANSP organisation on performance. They mainly relate to four issues, which are typically addressed in the Balanced Scorecard methodology. These issues are the internal organisation structure; the degree to which assets and activities are retained in-house; human resources; and relationship with customer. Not all organisational factors will directly affect cost-effectiveness; some enable or facilitate the achievement of performance when they are set in conformity with the business objectives. It is likely that no single model should constitute "best practice" in all circumstances.

- ANSP managerial and financial arrangements mainly relate to the following three issues: the quality of management; the collective bargaining process; and financial and accounting considerations. Most of the managerial and financial aspects are expected to directly affecting cost-effectiveness, since they have an impact, for example, on investment decisions, productivity and wage policies. The managerial and financial aspects are to some extent influenced by the ANSP organisational factors and by some of the exogenous factors (especially among the institutional and governance factors, and among the socioeconomic factors).

- A list of factors shall be considered in a comprehensive examination of the influence of ANSP operational and technical setup on performance. They mainly relate to the following three issues: operational structure (or organisation); operational concepts and processes; and operational flexibility. The operational and technical setup of an ANSP is expected to be influenced by both exogenous factors (typically the operational environment) and other endogenous factors (such as internal organisation and investment policy). The operational and technical setup is expected to affect both labour and capital productivity and the level of support costs.

4. CONCLUSIONS AND FURTHER RECOMMENDATIONS

The review of empirical studies and empirical results of impact of ANSP's involvement in partnerships on its performance allow to formulate the following conclusions:

1. The necessity of ANSPs involvement in different partnerships lies in several reasons: fragmentation of ANSPs at ATC level and in the technical infrastructure; high costs of provision of ANS; monopoly, lack of competition, weak oversight of the ANS market; lack of flexibility of human resources. The main benefits of involvement in different forms of partnerships are the following: to acquire expertise and access to needed resources, faster and better innovation, higher results of research and development activities and costs reduction, to cope with turbulence in their environments, to accomplish objectives they are unable to bring out alone, to address stakeholder's demands and develop or sustain a competitive advantage, and ultimate one applicable to the ANSPs - to improve overall performance.

2. The legal background for the ANSPs involvement in different partnerships (particular FABs) is defined in the SES-II legislative package, namely Regulation (EC) No. 1070/2009 amending Regulation (EC) No. 549/2004, as 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 optimized through enhanced cooperation among air navigation service providers or, when appropriate, an integrated provider.

3. There are plenty of forms and models of partnership across the different business areas. In the ANS industry, the most popular and widespread forms of partnership are public-private partnership (PPP), FAB and inter-FAB cooperation, alliances, consortias, industrial partnership, service provision partnership and networking. The main goal of those partnerships, imposed by SES legislation, is continuous improvement of ANSPs performance. Different approaches are classified as top –down (imposed by legislation: FABs), bottom –up (particularly ANSPs initiative: industrial partnership, alliances, consortia, initiatives, networks), and mixed one (when legislation just give the possibility to create some forms of partnership and ANSPs using this chance Inter-FAB, PPP).

4. Widely known multi–stakeholder partnerships models such as alliances, consortias, joint ventures / projects and cross – sector partnership as PPPs are becoming more popular due to the internet technologies – networks existing in European ANSPs landscape. Some of them transform into new models – FABs and industrial partnership. However, it should be noted that FABs and industrial partnership have features of multi – stakeholder partnerships and cross – sector partnership. Most perspective form of partnership is industrial partnership, as more business and performance oriented, which takes into account interests of all participating parties and because of it's bottom-up nature.

5. A conceptual model of impact of partnership on ANSP performance includes the following exogenous factors those outside the control of an ANSP: factors outside direct ANSP control (legal & socioeconomic conditions (country's economic indicators), and operational conditions (ANSP's operational indicators and traffic indicators)) and factors outside ANSP control but under influence of State and international institutions (national and international institutional & governance arrangements (ANSP's governance indicators and involvement of ANSP in FAB activity)). While endogenous factors are those entirely under the ANSP's control: factors under direct ANSP control (managerial and financial aspects (involvement in different partnerships, ANSP's performance indicators, and ANSP's financial indicators)).

6. Results of correlation analysis indicate about a positive statistically significant relationship between involvement of ANSP in FAB activity and its performance indicators. However, a positive statistically significant relationship between a number of partnership and ANSP performance indicators is observed only in some cases. However, the results of correlation analysis do not allow concluding about the causal relationship between involvement of ANSP in different partnerships on its performance.

The recommendations for modification of a conceptual model of impact of ANSP's involvement in partnerships on its performance are presented already in the previous section.

Leonidas Petrovskis


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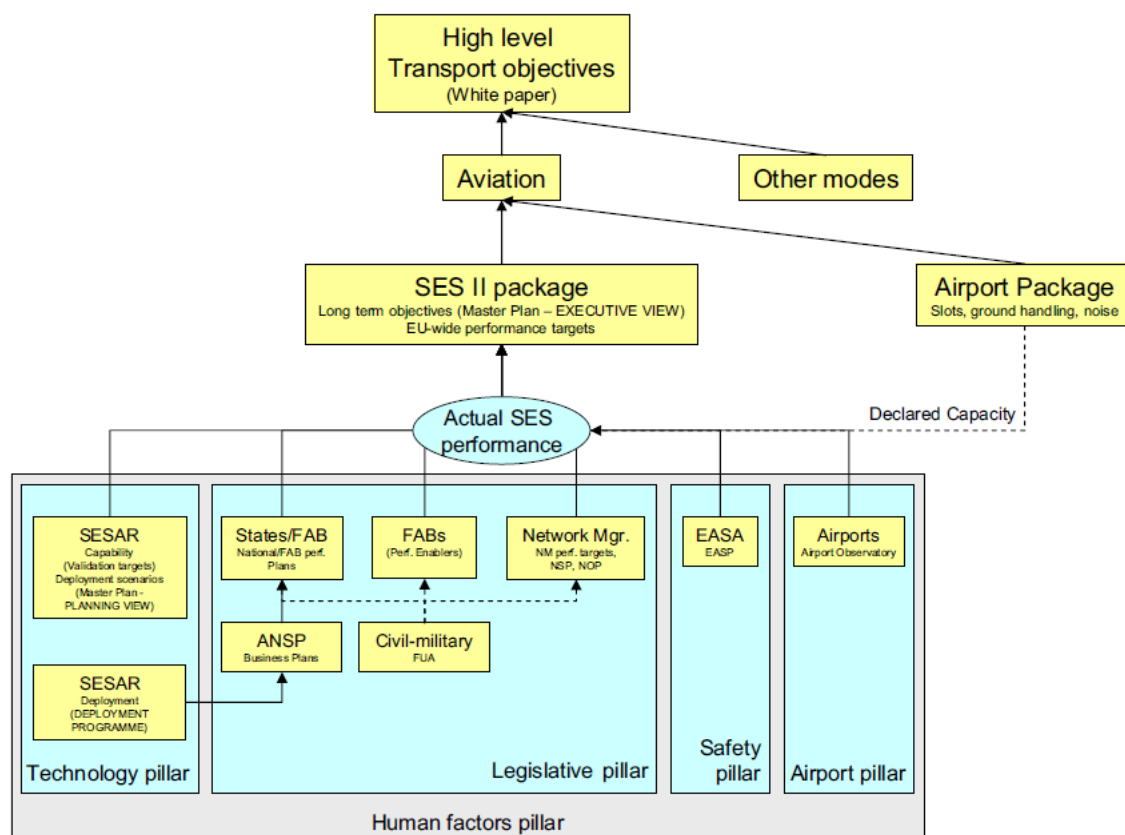


Figure 1. SES II Performance contribution to the overall SES Framework

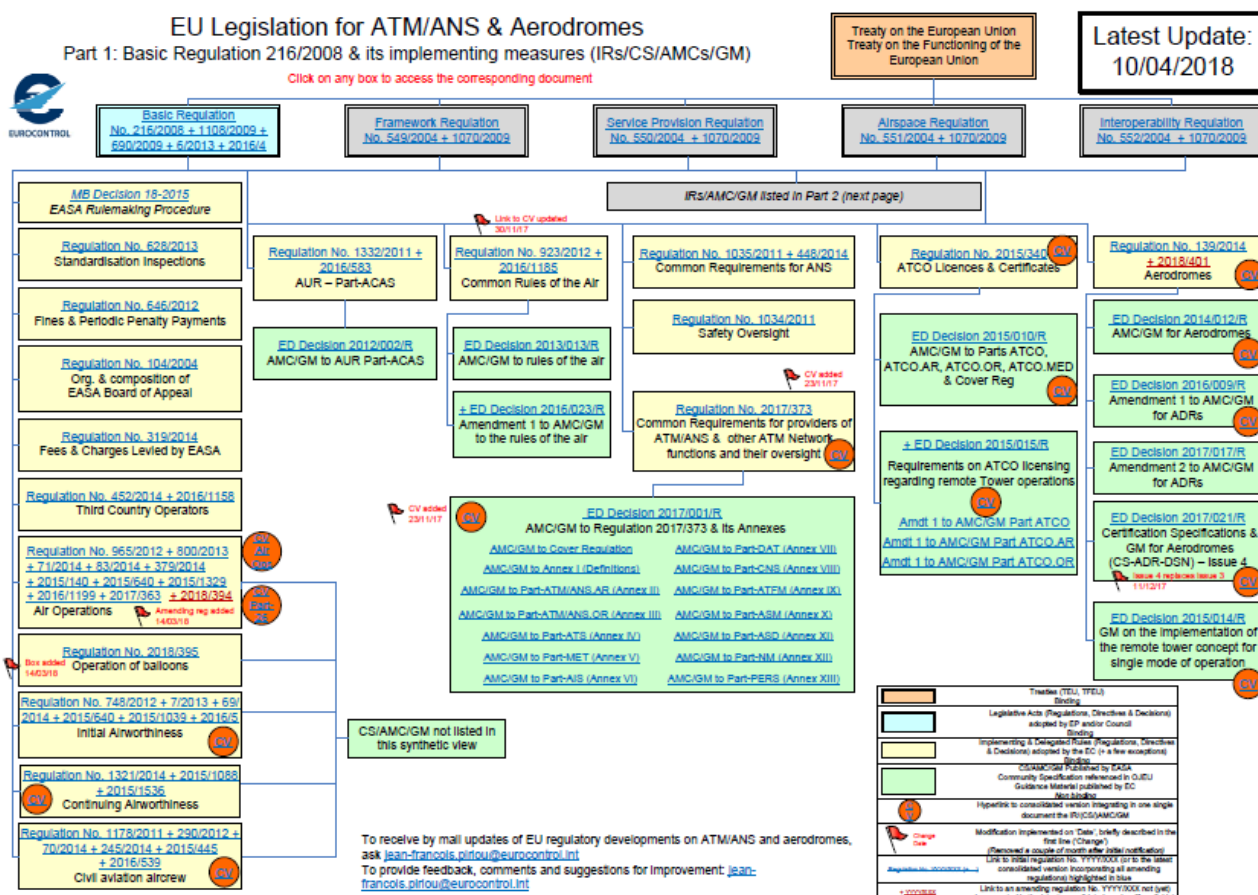


Figure 1. SES legislation's tree

Table 1. List of ANSPs included in data sample

Name of ANSP	Country
Albcontrol	Albania
ANS CR	Czech Republic
ARMATS	Armenia
Austro Control	Austria
Avinor (Continental)	Norway
Belgocontrol	Belgium
BULATSA	Bulgaria
Croatia Control	Croatia
DCAC Cyprus	Cyprus
DFS	Germany
DHMI	Turkey
DSNA	France
EANS	Estonia
ENAIRE	Spain
ENAV	Italy
Finavia	Finland
HCAA	Greece
HungaroControl	Hungary
IAA	Ireland
LFV	Sweden
LGS	Latvia
LPS	Slovak Republic
LVNL	Netherlands
MATS	Malta
M-NAV	The Former Yugoslav Republic of Macedonia
MoldATSA	Moldova
MUAC	ANS provided by EUROCONTROL (over Belgium, Netherlands, Luxembourg and part of Germany)
NATS (Continental)	United Kingdom
NAV Portugal (Continental)	Portugal
NAVIAIR	Denmark
Oro navigacija	Lithuania
PANSA	Poland
ROMATSA	Romania
Skyguide	Switzerland
Slovenia Control	Slovenia
SMATSA	Serbia and Montenegro
UkSATSE	Ukraine

Table 1. Description of dependent and independent (exogenous and endogenous) variables

Group of variables	Variable	Definition	Source
Country's economic indicators (independent)	Real GDP growth (RGDP)	Real GDP growth rate reflects the growth rate of GDP in terms of volumes. The GDP at current prices are valued in the prices of the previous year and the thus computed volume changes are imposed on the level of a reference year	Eurostat, IMF WEO
	Inflation rate (IR)	Inflation rate (Harmonised Index of Consumer Prices (HICP)) reflects consumer price inflation	Eurostat
	Comparative price level (CPL)	Comparative price level (comparative price level of final consumption by private households including indirect taxes) is the ratio between Purchasing power parities (PPPs) and market exchange rate for each country. PPPs are currency conversion rates that convert economic indicators expressed in national currencies to a common currency, called Purchasing Power Standard (PPS), which equalises the purchasing power of different national currencies and thus allows meaningful comparison. The ratio is shown in relation to the EU average (EU-28=100). If the index of the comparative price levels shown for a country is higher/lower than 100, the country concerned is relatively expensive/cheap as compared with the EU average (chain index)	Eurostat
ANSP's performance indicators (dependent)	En-route determined unit rate (EDUR)	The en-route ANS determined unit rate is defined as the En-route determined costs (DUC) expressed in Euros (in real terms (in 2009 prices)) divided by the Total en-route service units. DUC for en-route ANS addresses the costs for the provision of en-route air navigation services (chain index)	EUROCONTROL Performance Review Unit (PRU)
	ATCO-hour productivity (ATCOHP)	ATCO-hour productivity is defined as Composite flight-hours divided by ATCO-hours on duty (chain index)	EUROCONTROL Performance Review Unit (PRU)
	ATCO employment costs per ATCO-hour (ATCOEC)	ATCO employment costs per ATCO-hour is defined as Employment costs for ATCOs in OPS (in thousands Euros) divided by ATCO-hours on duty (chain index)	EUROCONTROL Performance Review Unit (PRU)
	Financial gate-to-gate cost-effectiveness (FGTGCE)	Financial gate-to-gate cost-effectiveness is determined as Gate-to-gate ATM/CNS provision costs divided by Composite flight-hours (chain index)	EUROCONTROL Performance Review Unit (PRU)
	Support staff ratio (SSR)	Support staff ratio is calculated as Total staff divided by Total ATCOs in OPS (chain index)	EUROCONTROL Performance Review Unit (PRU)
ANSP's governance indicators (independent)	Ownership structure of ANSP (OSANSP)	ANSP's ownership structure reflects the form of ANSP's ownership: stated-owned (1) or part-private-owned (0)	EUROCONTROL Performance Review Unit (PRU)
	Involvement of ANSP in FAB activity (FAB)	Involvement of ANSP in FAB activity denotes if the particular ANSP is involved in FAB activity or not.	Author's data
ANSP's financial indicators	Involvement in different partnerships (PART)	Number of different partnerships (e.g. consortiums, alliances, etc.) a particular ANSP is involved	Author's data

Group of variables	Variable	Definition	Source
(dependent)	Structure of ANS revenues (SANSPR)	Structure of ANS revenues is calculated as En-route ANS revenues divided by Total ANS revenues (chain index)	EUROCONTROL Performance Review Unit (PRU)
	Financial leverage of ANSP (FLANSP)	Financial leverage of ANSP is calculated as Capital and reserves to Total assets ratio of ANSP (chain index)	EUROCONTROL Performance Review Unit (PRU)
ANSP's operational indicators (independent)	Total flight-hours controlled by the ANSP (TFH)	Total flight-hours controlled by the ANSP during a year (chain index)	EUROCONTROL Performance Review Unit (PRU)
	IFR airport movements controlled by the ANSP (IFRA)	Total number of IFR airport movements controlled by the ANSP during a year (chain index)	EUROCONTROL Performance Review Unit (PRU)
	Composite flight-hours (CFH)	Composite flight-hours combine two separate output measures for en-route and terminal ANS provision. The composite gate-to-gate flight-hours are consequently calculated as Composite gate-to-gate flight-hours = En-route flight-hours + (0.27 x IFR airport movements) (chain index)	EUROCONTROL Performance Review Unit (PRU)
	Share of transit flights (overflights) controlled by the ANSP (STF)	Share of transit flights (overflights) controlled by the ANSP is calculated as transit flights (overflights) divided by total IFR flights controlled by the ANSP (chain index)	EUROCONTROL Performance Review Unit (PRU)
Traffic indicators (independent)	Adjusted traffic density indicator (ATD)	Traffic density is a measure of the amount of traffic that exists within a given unit of volume over a given unit of time. Adjusted traffic density indicator is a measure of the potential number of interactions between aircraft in a given volume of airspace controlled by a particular ANSP. Adjusted traffic density indicator is defined as the ratio between the hours of interactions and flight hours (Adjusted traffic density indicator = (Hours of interactions / Flight hours) x 60) (chain index)	EUROCONTROL Performance Review Unit (PRU)
	Relative vertical different interacting flows indicator (r_VDIF)	Vertical different interacting flows (VDIF) indicator is a measure of the complexity arising from the interactions between flights in different flight phases. Two aircraft are considered to interact vertically if they are simultaneously present in the same cell and have different attitudes (climbing-cruising-descending). Indicator is expressed as the duration of potential vertical interactions (in hours) per flight hour. The VDIF indicator is obtained by adding the expected duration of all potential vertical interactions in all the cells associated with an airspace controlled by a particular ANSP and then divided by the total flight hours associated with an ANSP (VDIF = Hours of vertical interactions / Flight hours). Relative vertical different interacting flows indicator (r_VDIF) is calculated as follows: $r_VDIF = VDIF / \text{Adjusted traffic density indicator}$ = Hours of vertical interactions / Hours of interactions (chain index)	EUROCONTROL Performance Review Unit (PRU)
	Relative horizontal different interacting flows indicator (r_HDIF)	Horizontal different interacting flows (HDIF) indicator is a measure of the complexity arising from the interactions between flights with different headings and is expressed as the duration of potential horizontal interactions (in hours) per flight hour. A horizontal interaction is defined as the simultaneous presence of two aircraft with different headings in a cell. The	EUROCONTROL Performance Review Unit (PRU)

Group of variables	Variable	Definition	Source
		heading used in the calculation is the one the aircraft was flying when it entered the cell. The expected duration of all potential horizontal interactions in all the cells associated with an airspace controlled by a particular ANSP are added together and then divided by the total flight hours associated with an ANSP ($\text{HDIF} = \text{Hours of horizontal interactions} / \text{Flight hours}$). Relative horizontal different interacting flows indicator (r_{HDIF}) is calculated as follows: $r_{\text{HDIF}} = \text{HDIF} / \text{Adjusted traffic density indicator} = \text{Hours of horizontal interactions} / \text{Hours of interactions (chain index)}$	
Traffic indicators (independent)	Relative speed different interacting flows indicator (r_{SDIF})	Speed different interacting flows (SDIF) indicator is a measure of the complexity arising from the interactions between aircraft with different speeds and is expressed as the duration of potential speed interactions (in hours) per flight hour. The expected duration of all potential speed interactions in all the cells associated with an airspace controlled by a particular ANSP are added together and then divided by the total flight hours associated with an ANSP ($r_{\text{SDIF}} = \text{Hours of speed interactions} / \text{Flight hours}$). Relative speed different interacting flows indicator (r_{SDIF}) is calculated as follows: $r_{\text{SDIF}} = \text{SDIF} / \text{Adjusted traffic density indicator} = \text{Hours of speed interactions} / \text{Hours of interactions (chain index)}$	EUROCONTROL Performance Review Unit (PRU)
	Structural traffic complexity index (STC)	The DIF indicators can also be interpreted as the percentage of interactions, which are vertical, horizontal or due to speed differences. It should be noted that one adjusted density interaction can fall into the vertical, horizontal and speed categories depending on the attitudes, altitudes and speeds of the aircraft. For this reason, the percentages do not add up to 100% (the maximum would be 300% if every interaction met all the criteria). The ANSP's complexity scores are influenced by two aspects: the structure of the traffic flows and traffic volume. The use of the r_{DIF} indicators allows these components to be separated. Adjusted density reflects the traffic volume while the structural index represents the structure of the traffic flows (Structural traffic complexity index = $r_{\text{VDIF}} + r_{\text{HDIF}} + r_{\text{SDIF}}$) (chain index)	EUROCONTROL Performance Review Unit (PRU)
	Aggregated traffic complexity score (ATC)	While the structure of the traffic flows and traffic volume affect the overall complexity they are combined in the chosen aggregation expressed as Aggregated traffic complexity score (Aggregated traffic complexity score = Adjusted traffic density indicator x Structural traffic complexity index)v (chain index)	EUROCONTROL Performance Review Unit (PRU)
	Traffic variability (one month) (TVM)	Traffic variability is the ratio between the amount of traffic handled by the ANSP in the peak month and the traffic handled on average month during the year (chain index)	EUROCONTROL Performance Review Unit (PRU)
	Traffic variability (one week) (TVW)	Traffic variability is the ratio between the amount of traffic handled by the ANSP in the peak week and the traffic handled on average week during the year (chain index)	EUROCONTROL Performance Review Unit (PRU)

Notes. The different interacting flows (DIF) indicators are highly correlated with adjusted density due to vertical, horizontal and speed interactions being subsets of adjusted density, which contains all interactions. These correlations are removed by using 'relative' indicators, r_{VDIF} , r_{HDIF} and r_{SDIF} , which are calculated by dividing the interaction indicators for each ANSP by respective adjusted density result.

ANNEX 5

Table 1. Statistical data

Year	ANSPs	FAB	OSANS P	TFH	IFRA	CFH	STF	EDUR	ATD	r_VDIF	r_HDIF	r_SDIF	STC	ATC	TVM	TVW	ATCOH P	ATCOE C	FGTGC E	SSR	SANSP R	FLANS P	RGDP	IR	CPL	FAB	FAB_Y	PART
2005	Albcontrol		1	25 867	16 614	30 163	0,86		3,55	0,07	0,30	0,08	0,45	1,59	1,48	1,50	0,56	0,01	0,45	6,46			5,5		51,40		0	0
2006	Albcontrol		1	25 823	16 822	30 071	0,86		3,53	0,07	0,32	0,06	0,45	1,58	1,49	1,52	0,40	0,01	0,46	5,78			5,9		52,80		0	0
2007	Albcontrol		1	30 965	18 968	35 808	0,87		4,06	0,06	0,32	0,05	0,43	1,76	1,45	1,50	0,45	0,01	0,43	5,00			6		530		0	0
2008	Albcontrol		1	32 052	19 797	37 217	0,87		3,99	0,06	0,33	0,05	0,44	1,77	1,35	1,38	0,55	0,01	0,44	5,63	0,93	0,50	7,5		55,40		0	0
2009	Albcontrol		1	34 624	20 583	40 038	0,87		4,60	0,06	0,32	0,05	0,43	1,99	1,51	1,55	0,57	0,01	0,45	5,80	0,91	0,51	3,4		53,60		0	0
2010	Albcontrol		1	38 833	21 022	44 388	0,88		5,54	0,06	0,33	0,05	0,43	2,41	1,44	1,45	0,57	0,02	0,46	6,59	0,93	0,57	3,7		50,30		0	0
2011	Albcontrol		1	41 803	22 949	47 888	0,88		6,03	0,05	0,35	0,04	0,44	2,64	1,45	1,46	0,58	0,03	0,45	5,71	0,93	0,60	2,5		49,10		0	0
2012	Albcontrol		1	40 982	20 543	46 445	0,89		6,28	0,05	0,35	0,04	0,45	2,80	1,46	1,48	0,53	0,03	0,50	5,52	0,94	0,65	1,4		47,30		0	0
2013	Albcontrol		1	41 539	19 919	46 835	0,90		6,61	0,05	0,35	0,04	0,45	2,95	1,53	1,55	0,55	0,03	0,49	5,95	0,94	0,68	1		48,20		1	0
2014	Albcontrol		1	41 812	18 056	46 627	0,91		6,65	0,05	0,37	0,05	0,47	3,13	1,53	1,53	0,62	0,04		6,67	0,93	0,72	1,8		48,20		0	0
2015	Albcontrol		1	43 150	20 912	48 742	0,90		6,63	0,05	0,37	0,06	0,49	3,22	1,53	1,55	0,45	0,03	0,51	4,74	0,94	0,75	2,2		46,80		1	0
2005	ARMATS		1																						0		0	0
2006	ARMATS		1																						0		0	0
2007	ARMATS		1																						0		0	0
2008	ARMATS		1																						0		0	0
2009	ARMATS		1	11 408	18 698	16 326	0,61		1,03	0,10	0,36	0,19	0,65	0,67	1,11	1,15	0,12	0,01	0,40	5,25	0,47	0,75			0		0	0
2010	ARMATS		1	12 537	20 872	18 052	0,61		1,17	0,09	0,37	0,17	0,62	0,73	1,10	1,14	0,14	0,01	0,36	5,25	0,54	0,73			0		0	0
2011	ARMATS		1	14 668	20 641	20 141	0,64		1,50	0,07	0,38	0,17	0,62	0,93	1,10	1,17	0,19	0,01	0,37	6,54	0,53	0,76			0		0	0
2012	ARMATS		1	13 988	21 292	19 650	0,62		1,37	0,08	0,39	0,15	0,62	0,84	1,07	1,09	0,19	0,01	0,42	6,59	0,52	0,83			0		0	0
2013	ARMATS		1	13 123	17 906	17 884	0,66		1,33	0,08	0,39	0,16	0,63	0,84	1,08	1,12	0,16	0,01	0,48	5,75	0,53	0,82			0		1	0
2014	ARMATS		1	13 311	21 106	18 939	0,58		1,25	0,10	0,35	0,20	0,65	0,81	1,09	1,22	0,17	0,01		4,82	0,49	0,86			0		1	0
2015	ARMATS		1	11 319	18 307	16 214	0,57		10,32	0,13	0,53	0,16	0,81	8,37	1,23	1,24	0,14	0,01	0,56	4,76	0,51	0,85			0		1	0
2005	Austro Control	FAB CE	1	264 120	370 470	359 924	0,55		7,11	0,24	0,50	0,24	0,98	6,94	1,22	1,24	0,91	0,10	0,47	3,12			2,2	2,1	100,1		0	11
2006	Austro Control	FAB CE	1	278 616	375 193	373 368	0,57		7,46	0,22	0,50	0,22	0,95	7,06	1,22	1,23	0,91	0,12	0,48	3,18			3,5	1,7	99,81		0	11
2007	Austro Control	FAB CE	1	304 699	398 226	406 374	0,58		8,11	0,23	0,51	0,22	0,95	7,75	1,20	1,22	0,96	0,13	0,46	3,11			3,7	2,2	99,71		0	11
2008	Austro Control	FAB CE	1	315 942	413 208	423 745	0,57		8,33	0,24	0,49	0,23	0,97	8,05	1,20	1,24	1,04	0,15	0,47	3,33	0,81	0,16	1,5	3,2	102,91		0	11
2009	Austro Control	FAB CE	1	289 279	369 881	386 571	0,58	65	8,10	0,21	0,49	0,21	0,92	7,47	1,20	1,21	0,95	0,15	0,50	3,29	0,82	0,16	-3,8	0,4	105,41		0	11
2010	Austro Control	FAB CE	1	286 216	373 656	384 945	0,58	66	8,27	0,21	0,49	0,22	0,92	7,60	1,21	1,22	0,96	0,15	0,52	3,32	0,81	0,17	1,8	1,7	104,71		0	11
2011	Austro Control	FAB CE	1	287 738	365 725	384 712	0,60	65	8,21	0,19	0,51	0,20	0,90	7,40	1,21	1,21	0,94	0,16	0,55	3,30	0,82	0,19	2,9	3,6	105,41		0	11
2012	Austro Control	FAB CE	1	279 393	355 141	373 835	0,60	66	8,23	0,19	0,51	0,20	0,91	7,48	1,22	1,23	0,94	0,16	0,58	3,09	0,82	0,21	0,7	2,6	104,61		0	11
2013	Austro Control	FAB CE	1	271 390	338 154	361 300	0,61	66	8,31	0,18	0,53	0,19	0,90	7,51	1,24	1,25	0,88	0,16	0,61	2,98	0,82	0,17	0	2,1	105,51		1	11
2014	Austro Control	FAB CE	1	276 826	336 938	366 680	0,63	60	8,71	0,17	0,53	0,19	0,88	7,68	1,29	1,30	0,90	0,14		2,95	0,83	0,16	0,8	1,5	105,21		1	11
2015	Austro Control	FAB CE	1	281 358	330 892	369 833	0,64	57	1,16	0,11	0,30	0,24	0,66	0,76	1,21	1,29	0,92	0,16	0,59	2,91	0,83	0,18	1,1	0,8	104,21		1	11
2005	Belgocontrol	FABEC	1	102 347	335 245	189 042	0,39		8,45	0,40	0,49	0,40	1,29	10,93	1,12	1,13	0,64	0,11	1,04	4,21			2,1	2,5	104,1		0	2
2006	Belgocontrol	FABEC	1	107 957	356 857	198 078	0,38		8,80	0,41	0,52	0,41	1,35	11,84	1,13	1,15	0,64	0,12	1,03	4,20			2,5	2,3	104,81		0	2
2007	Belgocontrol	FABEC	1	113 900	367 495	207 728	0,39		9,10	0,42	0,54	0,41	1,37	12,49	1,10	1,13	0,68	0,12	0,98	4,25			3,4	1,8	105,11		0	2
2008	Belgocontrol	FABEC	1	120 049	368 248	216 122	0,38		9,85	0,44	0,54	0,42	1,39	13,72	1,13	1,14	0,69	0,12	0,99	4,40	0,84	0,71	0,8	4,5	108,21		0	2
2009	Belgocontrol	FABEC	1	111 416	350 081	203 500	0,35	82	9,30	0,43	0,53	0,44	1,40	13,01	1,11	1,17	0,68	0,13	1,06	4,33	0,87	0,73	-2,3	0	110,21		0	2
2010	Belgocontrol	FABEC	1	110 156	353 429	203 541	0,35	72	8,76	0,42	0,53	0,42	1,36	11,93	1,13	1,18	0,69	0,13	1,06	4,12	0,85	0,67	2,7	2,3	109,21		0	2
2011	Belgocontrol	FABEC	1	114 337	380 572	215 248	0,33	64	8,04	0,41	0,55	0,42	1,38	11,06	1,13	1,14	0,70	0,13	0,99	4,06	0,85	0,64	1,8	3,4	109,11		0	2
2012	Belgocontrol	FABEC	1	108 640	364 616	205 602	0,35	66	7,36	0,41	0,56	0,45	1,42	10,45	1,12	1,18	0,68	0,13	1,07	3,86	0,85	0,63	0,2	2,6	107,91		0	2
2013	Belgocontrol	FABEC	1	106 453	351 664	199 955	0,36	65	7,19	0,39	0,55	0,45	1,40	10,08	1,15	1,19	0,67	0,14	1,12	3,58	0,85	0,65	0,2	1,2	108,71		1	2
2014	Belgocontrol	FABEC	1	107 974	365 318	205 396	0,35	60	7,55	0,38	0,55	0,45	1,38	10,44	1,16	1,17	0,67	0,15		3,31	0,85	0,67	1,4	0,5	106,91		1	2
2015	Belgocontrol	FABEC	1	113 111	380 163	214 760	0,36	59	8,37	0,17	0,56	0,19	0,92	7,72	1,26	1,27	0,69	0,14	0,94	3,35	0,74	0,69	1,4	0,6	105,41		1	2
2005	BULATSA	Danube FAB	1	130 427	68 941	148 255	0,83		5,04	0,04	0,24	0,07	0,34	1,74	1,46	1,51	0,45	0,04	0,58	5,37			7,1	6	40,81		0	4
2006	BULATSA	Danube FAB	1	136 846	82 471	157 673	0,80		5,21	0,05	0,24	0,07	0,37	1,91	1,46	1,47	0,50	0,04	0,53	5,48			6,9	7,4	43,81		0	4
2007	BULATSA	Danube FAB	1	152 039	94 617	176 197	0,79		5,98	0,05	0,25	0,06	0,36	2,14	1,45	1,45	0,56	0,04	0,47	5,39			7,3	7,6	45,81		0	4
2008	BULATSA	Danube FAB	1	161 001	98 635	186 734	0,80		6,20	0,05	0,24	0,06	0,35	2,18	1,44	1,45	0,63	0,05	0,48	5,57	0,89	0,89	6	12	50,11		0	4
2009	BULATSA	Danube FAB	1	161 231	93 814	185 907	0,81	43	6,91	0,06	0,24	0,06	0,36	2,47	1,42	1,45	0,65	0,05	0,49	5,60	0,90	0,85	-3,6	2,5	53,1		0	4
2010	BULATSA	Danube FAB	1	168 894	82 055	190 575	0,84	39	6,78	0,05	0,25	0,06	0,36	2,45	1,42	1,44	0,75	0,05	0,45	6,24	0,91	0,85	1,3	3	52,1		0	4
2011	BULATSA	Danube FAB	1	181 981	83 307	204 071	0,85	35	7,01	0,05	0,29	0,06	0,40	2,81	1,42	1,45	0,74	0,05	0,43	5,51	0,92	0,76	1,9					

Year	ANSPs	FAB	OSANS P	TFH	IFRA	CFH	STF	EDUR	ATD	r_VDIF	r_HDIF	r_SDIF	STC	ATC	TVM	TVW	ATCOH P	ATCOE C	FGTGC E	SSR	SANSP R	FLANS P	RGDP	IR	CPL	FAB	FAB_Y	PART
2013	BULATSA	Danube FAB	1	180 911	71 339	199 879	0,87	32	6,92	0,06	0,31	0,06	0,43	3,01	1,43	1,44	0,64	0,05	0,41	4,59	0,88	0,85	0,9	0,4	49,41		1	4
2014	BULATSA	Danube FAB	1	219 380	75 736	239 577	0,89	27	8,63	0,06	0,33	0,10	0,49	4,26	1,46	1,48	0,75	0,07		4,43	0,91	0,78	1,3	-1,6	48,1		1	4
2015	BULATSA	Danube FAB	1	249 764	76 716	270 277	0,90	26	2,14	0,26	0,45	0,26	0,97	2,08	1,12	1,14	0,82	0,07	0,36	4,17	0,91	0,71	3,6	-1,1	46,91		1	4
2005	DCAC Cyprus	BLUE MED FAB	1	95 940	61 432	111 826	0,71		3,05	0,21	0,36	0,12	0,69	2,09	1,19	1,21	0,92	0,04	0,35	2,98			3,7	2	88,41		0	2
2006	DCAC Cyprus	BLUE MED FAB	1	100 092	61 130	115 530	0,72		3,19	0,18	0,35	0,11	0,64	2,03	1,16	1,20	0,84	0,04	0,37	2,99			4,5	2,2	89,41		0	2
2007	DCAC Cyprus	BLUE MED FAB	1	111 072	62 181	126 948	0,74		3,50	0,16	0,36	0,11	0,63	2,21	1,17	1,19	0,85	0,04	0,34	3,79			4,8	2,2	86,61		0	2
2008	DCAC Cyprus	BLUE MED FAB	1	124 343	64 309	141 121	0,76		3,77	0,15	0,39	0,09	0,63	2,38	1,20	1,26	0,89	0,06	0,34	5,28	0,79	0,00	3,9	4,4	88,61		0	2
2009	DCAC Cyprus	BLUE MED FAB	1	121 516	62 146	137 863	0,77	34	4,00	0,15	0,39	0,10	0,64	2,57	1,20	1,28	0,76	0,04	0,37	2,82	0,83	0,66	-1,8	0,2	91,71		0	2
2010	DCAC Cyprus	BLUE MED FAB	1	130 669	63 835	147 536	0,78	32	4,40	0,14	0,39	0,11	0,63	2,79	1,17	1,20	0,78	0,05	0,37	2,69	1,00	0,61	1,3	2,6	93,31		0	2
2011	DCAC Cyprus	BLUE MED FAB	1	130 396	63 560	147 250	0,77	31	4,38	0,14	0,37	0,12	0,63	2,77	1,21	1,29	0,72	0,05	0,35	2,37	0,86	0,44	0,3	3,5	94,51		0	2
2012	DCAC Cyprus	BLUE MED FAB	1	126 759	61 560	143 130	0,77	34	4,36	0,14	0,36	0,11	0,61	2,67	1,20	1,26	0,84	0,07	0,39	2,32	0,86	0,50	-3,1	3,1	93,81		0	2
2013	DCAC Cyprus	BLUE MED FAB	1	134 793	54 719	149 342	0,80	32	4,89	0,14	0,38	0,10	0,63	3,06	1,20	1,25	0,87	0,07	0,36	2,20	0,87	0,40	-5,9	0,4	93,31		1	2
2014	DCAC Cyprus	BLUE MED FAB	1	146 777	57 247	162 044	0,81	30	5,27	0,16	0,39	0,11	0,66	3,46	1,21	1,23	0,94	0,07		2,29	0,87	0,40	-1,4	-0,3	91,21		1	2
2015	DCAC Cyprus	BLUE MED FAB	1	153 140	58 225	168 708	0,82	31	8,04	0,38	0,56	0,45	1,39	11,16	1,16	1,18	0,87	0,05	0,35	2,09	0,89	0,36	2	-1,5	87,71		1	2
2005	Croatia Control	FAB CE	1	136 695	75 878	156 317	0,76		4,78	0,08	0,50	0,11	0,68	3,27	1,45	1,48	0,54	0,05	0,36	3,66			4,2	3	70,51		0	10
2006	Croatia Control	FAB CE	1	135 436	79 027	155 394	0,76		4,64	0,07	0,51	0,11	0,69	3,19	1,42	1,43	0,60	0,05	0,38	3,66			4,8	3,3	70,91		0	10
2007	Croatia Control	FAB CE	1	156 328	85 126	178 062	0,78		5,40	0,07	0,51	0,10	0,68	3,70	1,42	1,43	0,67	0,06	0,35	3,81			5,2	2,7	70,51		0	10
2008	Croatia Control	FAB CE	1	162 388	86 318	184 907	0,79		5,29	0,07	0,49	0,09	0,65	3,43	1,39	1,41	0,68	0,06	0,37	3,66	0,92	0,60	2,1	5,8	73,11		0	10
2009	Croatia Control	FAB CE	1	168 605	86 246	191 291	0,79		5,58	0,07	0,48	0,09	0,64	3,54	1,44	1,46	0,63	0,06	0,36	3,36	0,89	0,61	-7,4	2,2	73,91		0	10
2010	Croatia Control	FAB CE	1	181 496	84 344	203 782	0,82		6,51	0,06	0,47	0,08	0,61	4,00	1,41	1,42	0,63	0,07	0,36	3,20	0,89	0,59	-1,4	1,1	73,41		0	10
2011	Croatia Control	FAB CE	1	194 395	83 807	216 617	0,83		7,14	0,05	0,48	0,08	0,61	4,33	1,43	1,45	0,66	0,08	0,38	3,23	0,90	0,57	-0,3	2,2	71,51		0	10
2012	Croatia Control	FAB CE	1	193 518	82 229	215 385	0,83		7,48	0,05	0,48	0,07	0,61	4,55	1,46	1,47	0,67	0,08	0,38	3,23	0,89	0,51	-2,2	3,4	68,81		0	10
2013	Croatia Control	FAB CE	1	194 577	83 190	216 696	0,83		7,98	0,06	0,49	0,07	0,61	4,86	1,52	1,52	0,71	0,09	0,41	3,18	0,90	0,48	-0,6	2,3	68,11		1	10
2014	Croatia Control	FAB CE	1	205 093	87 564	228 444	0,83		8,25	0,05	0,51	0,08	0,64	5,26	1,52	1,52	0,68	0,08		3,01	0,90	0,47	-0,1	0,2	66,1		1	10
2015	Croatia Control	FAB CE	1	208 112	90 508	232 312	0,83	45	9,78	0,06	0,33	0,11	0,50	4,86	1,38	1,41	0,73	0,09	0,41	3,02	0,89	0,50	2,3	-0,3	64,91		1	10
2005	ANS CR	FAB CE	1	196 208	169 463	240 031	0,71		6,79	0,18	0,48	0,20	0,86	5,82	1,16	1,18	0,93	0,06	0,35	5,18			6,5	1,6	58,31		0	8
2006	ANS CR	FAB CE	1	201 875	178 751	247 017	0,70		6,83	0,18	0,49	0,21	0,89	6,07	1,18	1,20	0,95	0,07	0,41	5,08			6,9	2,1	62,51		0	8
2007	ANS CR	FAB CE	1	210 622	188 373	258 718	0,70		6,91	0,19	0,52	0,21	0,93	6,40	1,17	1,19	0,92	0,09	0,45	4,85			5,6	2,9	63,1		0	8
2008	ANS CR	FAB CE	1	223 589	194 702	274 385	0,70		7,18	0,21	0,53	0,23	0,97	6,96	1,18	1,19	0,95	0,08	0,46	4,89	0,77	0,87	2,7	6,3	72,31		0	8
2009	ANS CR	FAB CE	1	218 769	180 152	266 155	0,71	45	7,34	0,18	0,51	0,22	0,92	6,75	1,21	1,22	0,93	0,08	0,44	4,71	0,80	0,90	-4,8	0,6	68,81		0	8
2010	ANS CR	FAB CE	1	228 245	170 064	273 180	0,74	43	8,18	0,17	0,50	0,20	0,87	7,15	1,22	1,23	0,94	0,09	0,46	4,63	0,82	0,89	2,3	1,2	71,61		0	8
2011	ANS CR	FAB CE	1	232 525	165 232	276 337	0,76	41	8,30	0,17	0,52	0,19	0,88	7,27	1,21	1,22	0,93	0,09	0,47	4,60	0,82	0,87	1,8	2,2	73,51		0	8
2012	ANS CR	FAB CE	1	224 495	144 781	262 997	0,78	40	8,54	0,15	0,53	0,19	0,87	7,43	1,20	1,21	0,89	0,08	0,48	4,55	0,83	0,89	-0,8	3,5	71,21		0	8
2013	ANS CR	FAB CE	1	224 185	139 095	261 168	0,79	40	9,15	0,14	0,53	0,17	0,83	7,63	1,22	1,24	0,87	0,08	0,48	4,56	0,85	0,91	-0,5	1,4	68,21		1	8
2014	ANS CR	FAB CE	1	226 714	136 646	263 155	0,80	41	9,58	0,13	0,53	0,16	0,83	7,92	1,23	1,24	0,87	0,08		4,58	0,85	0,93	2,7	0,4	62,91		1	8
2015	ANS CR	FAB CE	1	237 734	141 497	275 568	0,81	39	8,34	0,05	0,54	0,08	0,67	5,60	1,49	1,50	0,96	0,09	0,44	4,67	0,85	0,91	5,3	0,3	62,61		1	8
2005	NAVIAR	Danish-Swedish FAB	1	197 144	359 638	290 147	0,41		3,87	0,19	0,50	0,21	0,90	3,48	1,09	1,11	0,83	0,06	0,36	2,87			2,3	1,7	137,1		0	7
2006	NAVIAR	Danish-Swedish FAB	1	206 939	346 401	294 420	0,44		4,01	0,17	0,52	0,22	0,92	3,67	1,10	1,11	0,85	0,06	0,35	2,98			3,9	1,8	134,91		0	7
2007	NAVIAR	Danish-Swedish FAB	1	214 830	352 553	304 843	0,46		4,17	0,17	0,52	0,21	0,90	3,75	1,09	1,12	0,82	0,07	0,39	2,80			0,9	1,7	132,1		0	7
2008	NAVIAR	Danish-Swedish FAB	1	216 259	363 380	311 062	0,44		4,06	0,18	0,54	0,20	0,92	3,73	1,11	1,12	0,95	0,08	0,41	3,52	0,73	0,01	-0,5	3,6	135,21		0	7
2009	NAVIAR	Danish-Swedish FAB	1	197 218	328 788	283 701	0,44	76	3,95	0,18	0,54	0,20	0,93	3,66	1,09	1,13	0,93	0,09	0,46	3,55	0,71	0,04	-4,9	1	138,51		0	7
2010	NAVIAR	Danish-Swedish FAB	1	204 222	341 727	294 514	0,44	69	4,04	0,18	0,55	0,21	0,93	3,78	1,12	1,14	0,96	0,09	0,42	3,51	0,73	0,41	1,9	2,2	137,51		0	7
2011	NAVIAR	Danish-Swedish FAB	1	212 073	345 967	303 808	0,46	63	3,87	0,19	0,56	0,22	0,97	3,77	1,09	1,14	1,02	0,09	0,37	3,50	0,73	0,44	1,3	2,7	139,1		0	7
2012	NAVIAR	Danish-Swedish FAB	1	201 374	325 816	288 018	0,47	63	3,49	0,18	0,57	0,21	0,96	3,36	1,09	1,13	0,98	0,10	0,40	3,45	0,74	0,46	0,2	2,4	138,1		0	7
2013	NAVIAR	Danish-Swedish FAB	1	210 182	329 173	297 704	0,48	59	3,55	0,18	0,57	0,20	0,95	3,36	1,12	1,15	1,02	0,10	0,37	3,28	0,75	0,49	0,9	0,5	138,21		1	7
2014	NAVIAR	Danish-Swedish FAB	1	209 633	332 873	298 402	0,47	57	3,56	0,18	0,55	0,20	0,93	3,32	1,11	1,12	0,99	0,10		2,97	0,74	0,51	1,6	0,4	139,1		1	7
2015	NAVIAR	Danish-Swedish FAB	1	213 579	338 390	304 059	0,47	56	5,57	0,16	0,39	0,12	0,67	3,71	1,26	1,32	1,00	0,10	0,37	2,98	0,75	0,59	1,6	0,2	135,71		1	7
2005	EANS	North European FAB	1	41 098	35 326	50 233	0,71		2,60	0,19	0,29	0,14	0,61	1,58	1,13	1,17	1,15	0,03	0,15	3,79			9,4	4,1	62,41		0	3
2006	EANS	North European FAB	1	47 697	32 034	55 787	0,76		3,43	0																		

Year	ANSPs	FAB	OSANS P	TFH	IFRA	CFH	STF	EDUR	ATD	r_VDIF	r_HDIF	r_SDIF	STC	ATC	TVM	TVW	ATCOH P	ATCOE C	FGTGC E	SSR	SANSR R	FLANS P	RGDP	IR	CPL	FAB	FAB_Y	PART
2006	Finavia	North European FAB	1	112 489	268 738	180 357	1,00		2,01	0,24	0,23	0,31	0,78	1,57	1,08	1,14	0,68	0,07	0,33	2,73			4,1	1,3	118,71		0	3
2007	Finavia	North European FAB	1	112 125	264 703	179 709	1,00		2,06	0,22	0,26	0,29	0,76	1,57	1,08	1,14	0,72	0,07	0,35	2,65			5,2	1,6	114,81		0	3
2008	Finavia	North European FAB	1	116 290	271 335	187 079	1,00		2,30	0,27	0,32	0,33	0,92	2,11	1,09	1,13	0,62	0,06	0,35	2,49	0,60	0,00	0,7	3,9	117,1		0	3
2009	Finavia	North European FAB	1	108 449	253 615	175 159	1,00	41	2,01	0,26	0,34	0,35	0,95	1,90	1,10	1,13	0,61	0,06	0,38	2,48	0,60	0,52	-8,3	1,6	120,21		0	3
2010	Finavia	North European FAB	1	110 485	249 596	176 434	1,00	39	1,95	0,27	0,34	0,36	0,98	1,90	1,13	1,16	0,65	0,07	0,38	2,37	0,63	0,53	3	1,7	119,61		0	3
2011	Finavia	North European FAB	1	124 093	275 765	197 214	1,00	46	2,05	0,28	0,34	0,37	0,99	2,04	1,09	1,15	0,68	0,07	0,37	2,18	0,63	0,49	2,6	3,3	120,71		0	3
2012	Finavia	North European FAB	1	114 641	247 712	180 515	1,00	52	1,76	0,27	0,35	0,38	1,01	1,78	1,08	1,12	0,63	0,07	0,39	2,24	0,69	0,46	-1,4	3,2	121,1		0	3
2013	Finavia	North European FAB	1	106 960	232 810	168 860	1,00	51	1,70	0,26	0,33	0,36	0,94	1,60	1,08	1,10	0,59	0,07	0,42	2,07	0,68	0,47	-0,8	2,2	122,61		1	3
2014	Finavia	North European FAB	1	108 085	235 694	170 939	1,00	50	1,70	0,25	0,33	0,35	0,93	1,57	1,10	1,11	0,61	0,08		2,06	0,70	0,60	-0,6	1,2	121,61		1	3
2015	Finavia	North European FAB	1	103 865	233 491	166 297	1,00	53	11,76	0,13	0,28	0,18	0,59	6,99	1,27	1,28	0,62	0,09	0,40	1,84	0,70	0,63	0	-0,2	119,1		1	3
2005	DSNA	FABEC	1	2 077 416	1 852 204	2 556 398	0,30		7,97	0,16	0,39	0,15	0,70	5,57	1,14	1,16	0,73	0,06	0,46	3,47			1,6	1,9	104,61		0	7
2006	DSNA	FABEC	1	2 178 245	1 902 630	2 658 738	0,31		8,44	0,16	0,38	0,15	0,70	5,87	1,15	1,16	0,75	0,07	0,45	3,33			2,4	1,9	105,41		0	7
2007	DSNA	FABEC	1	2 302 172	1 949 615	2 799 945	0,33		9,11	0,16	0,39	0,15	0,70	6,36	1,15	1,17	0,79	0,08	0,47	3,32			2,4	1,6	105,21		0	7
2008	DSNA	FABEC	1	2 291 924	1 941 200	2 798 368	0,33		9,43	0,16	0,39	0,14	0,70	6,60	1,17	1,18	0,81	0,09	0,48	3,28	0,80	0,21	0,2	3,2	109,11		0	7
2009	DSNA	FABEC	1	2 128 651	1 825 953	2 608 943	0,32	66	9,33	0,16	0,39	0,14	0,69	6,47	1,17	1,20	0,75	0,09	0,53	3,00	0,80	0,23	-2,9	0,1	110,91		0	7
2010	DSNA	FABEC	1	2 099 436	1 808 548	2 577 298	0,33	67	9,33	0,15	0,39	0,14	0,69	6,44	1,20	1,22	0,73	0,09	0,55	2,92	0,81	0,27	2	1,7	109,61		0	7
2011	DSNA	FABEC	1	2 145 373	1 892 868	2 647 284	0,34	61	9,64	0,15	0,41	0,14	0,70	6,77	1,18	1,19	0,74	0,09	0,54	2,90	0,81	0,31	2,1	2,3	109,41		0	7
2012	DSNA	FABEC	1	2 117 415	1 921 795	2 628 477	0,32	61	9,80	0,15	0,42	0,14	0,71	6,93	1,20	1,21	0,76	0,10	0,55	2,87	0,80	0,00	0,2	2,2	108,31		0	7
2013	DSNA	FABEC	1	2 121 262	1 889 756	2 623 718	0,32	60	10,06	0,15	0,42	0,13	0,70	7,07	1,22	1,23	0,75	0,10	0,55	2,87	0,81	1,00	0,6	1	107,51		1	7
2014	DSNA	FABEC	1	2 154 183	1 821 345	2 639 898	0,36	59	10,51	0,14	0,43	0,13	0,70	7,33	1,22	1,23	0,74	0,10		2,78	0,81	1,00	0,9	0,6	106,81		1	7
2015	DSNA	FABEC	1	2 184 317	1 849 423	2 678 824	0,36	60	10,58	0,14	0,43	0,12	0,70	7,35	1,22	1,23	0,77	0,10	0,57	2,80	0,83	1,00	1,1	0,1	104,61		1	7
2005	DFS	FABEC	1	1 283 046	2 045 362	1 811 979	0,23		9,66	0,32	0,53	0,27	1,12	10,83	1,12	1,13	0,82	0,10	0,55	2,95			0,7	1,9	102,31		0	6
2006	DFS	FABEC	1	1 342 045	2 097 682	1 871 797	0,24		10,09	0,31	0,54	0,26	1,12	11,25	1,12	1,15	0,86	0,11	0,50	2,80			3,7	1,8	102,1		0	6
2007	DFS	FABEC	1	1 403 679	2 159 861	1 955 132	0,25		10,39	0,31	0,54	0,25	1,10	11,44	1,11	1,12	0,91	0,12	0,42	2,72			3,3	2,3	101,11		0	6
2008	DFS	FABEC	1	1 443 062	2 163 663	2 007 545	0,26		10,73	0,31	0,54	0,25	1,09	11,72	1,12	1,13	1,02	0,14	0,43	2,79	0,77	0,19	1,1	2,8	103,41		0	6
2009	DFS	FABEC	1	1 333 214	2 005 398	1 860 706	0,26	73	10,25	0,30	0,53	0,26	1,08	11,07	1,11	1,14	0,96	0,14	0,50	2,94	0,77	0,26	-5,6	0,2	105,51		0	6
2010	DFS	FABEC	1	1 363 222	2 006 451	1 893 375	0,28	69	10,44	0,29	0,53	0,26	1,08	11,26	1,15	1,15	0,98	0,15	0,49	3,08	0,77	0,28	4,1	1,1	104,11		0	6
2011	DFS	FABEC	1	1 412 603	2 059 372	1 958 658	0,28	70	10,45	0,28	0,55	0,26	1,09	11,36	1,13	1,14	1,03	0,15	0,50	3,32	0,78	0,30	3,7	2,5	102,91		0	6
2012	DFS	FABEC	1	1 379 454	2 000 877	1 911 546	0,28	76	10,28	0,28	0,56	0,25	1,09	11,19	1,13	1,14	1,03	0,17	0,57	3,27	0,78	0,34	0,5	2,1	101,51		0	6
2013	DFS	FABEC	1	1 347 911	1 932 888	1 861 835	0,30	73	10,18	0,27	0,57	0,24	1,08	11,03	1,15	1,16	1,05	0,18	0,57	3,22	0,78	0,29	0,5	1,6	103,21		1	6
2014	DFS	FABEC	1	1 361 858	1 947 971	1 881 337	0,30	73	10,23	0,26	0,57	0,24	1,08	11,01	1,15	1,17	1,07	0,20		3,08	0,77	0,27	1,9	0,8	101,81		1	6
2015	DFS	FABEC	1	1 371 301	1 971 046	1 898 328	0,30	71	3,62	0,15	0,32	0,27	0,75	2,71	1,14	1,16	1,11	0,23	0,55	2,88	0,80	0,27	1,7	0,1	100,31		1	6
2005	HCAA	BLUE MED FAB	1	428 460	385 736	528 212	0,30		3,35	0,14	0,35	0,11	0,61	2,03	1,45	1,46			0,31	1,86			0,6	3,5	85,41		0	2
2006	HCAA	BLUE MED FAB	1	436 055	408 797	539 293	0,28		3,39	0,14	0,37	0,11	0,62	2,11	1,49	1,50	0,64	0,07	0,41	3,18			5,7	3,3	86,1		0	2
2007	HCAA	BLUE MED FAB	1	467 471	434 762	578 474	0,30		3,55	0,14	0,37	0,10	0,61	2,18	1,48	1,49	0,69	0,07	0,38	3,18			3,3	3	88,61		0	2
2008	HCAA	BLUE MED FAB	1	483 624	493 240	534 039	0,70		3,74	0,13	0,37	0,10	0,60	2,25	1,48	1,49	0,69	0,08	0,40	3,53	1,00		-0,3	4,2	90,61		0	2
2009	HCAA	BLUE MED FAB	1	471 704	205 566	525 775	0,68	43	3,87	0,13	0,39	0,11	0,63	2,43	1,48	1,50	0,67	0,08	0,39	3,53	1,00	0,00	-4,3	1,3	94,1		0	2
2010	HCAA	BLUE MED FAB	1	487 838	187 517	537 385	0,71	35	4,28	0,11	0,39	0,09	0,59	2,52	1,45	1,47	0,69	0,08	0,36	3,53	0,93	0,00	-5,5	4,7	95,81		0	2
2011	HCAA	BLUE MED FAB	1	480 362	169 431	525 288	0,74	32	4,19	0,11	0,38	0,09	0,57	2,39	1,51	1,54	0,74	0,08	0,35	3,72	0,93	0,00	-9,1	3,1	95,71		0	2
2012	HCAA	BLUE MED FAB	1	460 892	149 418	500 627	0,76	33	4,31	0,10	0,38	0,08	0,56	2,41	1,53	1,55	0,71	0,08	0,35	3,72	0,88	0,00	-7,3	1	93,11		0	2
2013	HCAA	BLUE MED FAB	1	445 796	135 455	481 811	0,78	33	4,21	0,10	0,38	0,08	0,55	2,33	1,58	1,61	0,68	0,08	0,35	3,59	0,89	1,00	-3,2	-0,9	89,81		1	2
2014	HCAA	BLUE MED FAB	1	480 211	387 838	583 639	0,43	30	4,55	0,10	0,40	0,08	0,58	2,66	1,64	1,64	0,69	0,05		3,35	0,88	1,00	0,7	-1,4	87,11		1	2
2015	HCAA	BLUE MED FAB	1	497 788	414 095	608 512	0,42	28	6,89	0,15	0,38	0,13	0,65	4,49	1,26	1,27	0,74	0,05	0,28	3,41	0,90	1,00	-0,3	-1,1	85,1		1	2
2005	HungaroControl	FAB CE	1	194 635	123 301	226 521	0,79		6,65	0,11	0,38	0,14	0,64	4,26	1,32	1,33	0,84	0,05	0,28	3,62			4,4	3,5	62,51		0	6
2006	HungaroControl	FAB CE	1	198 194	125 779	229 958	0,79		6,72	0,10	0,40	0,13	0,63	4,26	1,33	1,34	0,83	0,05	0,32	3,62			3,9	4	60,11		0	6
2007	HungaroControl	FAB CE	1	200 488	124 432	232 258	0,80		6,96	0,09	0,42	0,13	0,64	4,44	1,32	1,33	0,83	0,06	0,33	3,63			0,4	7,9	66,41		0	6
2008	HungaroControl	FAB CE	1	202 210	118 391	233 097	0,81		7,13	0,09	0,44	0,13	0,66	4,70	1,34	1,34	0,82	0,06	0,36	3,74	0,86	0,67	0,9	6	68,51		0	6
2009	HungaroControl	FAB CE	1	195 011	109 203	223 735	0,82	32	7,34	0,08	0,44	0,13	0,65	4,75	1,34	1,36	0,84	0,07	0,38	4,08	0,82	0,67	-6,6	4	62,81		0	6

Year	ANSPs	FAB	OSANS P	TFH	IFRA	CFH	STF	EDUR	ATD	r_VDIF	r_HDIF	r_SDIF	STC	ATC	TVM	TVW	ATCOH P	ATCOE C	FGTGC E	SSR	SANSP R	FLANS P	RGDP	IR	CPL	FAB	FAB_Y	PART
2010	IAA	UK-Ireland FAB	1	253 091	207 552	307 931	0,59	31	4,08	0,07	0,22	0,10	0,40	1,61	1,16	1,21	0,92	0,09	0,43	2,30	0,84	0,26	1,8	-1,6	118,9	0	7	
2011	IAA	UK-Ireland FAB	1	261 641	207 586	316 684	0,61	31	4,12	0,07	0,22	0,11	0,40	1,64	1,15	1,21	0,95	0,09	0,45	2,35	0,82	0,12	3	1,2	118,9	0	7	
2012	IAA	UK-Ireland FAB	1	263 793	207 193	318 891	0,60	28	4,18	0,07	0,23	0,11	0,40	1,68	1,15	1,17	1,02	0,10	0,42	2,36	0,85	0,23	0	1,9	117,9	0	7	
2013	IAA	UK-Ireland FAB	1	266 629	214 356	323 623	0,59	27	4,06	0,07	0,24	0,13	0,45	1,81	1,18	1,19	1,04	0,10	0,40	2,22	0,84	0,36	1,6	0,5	120,6	1	7	
2014	IAA	UK-Ireland FAB	1	276 582	225 814	336 801	0,58	26	3,96	0,08	0,25	0,16	0,49	1,95	1,20	1,27	1,08	0,10		2,11	0,85	0,33	8,3	0,3	122,8	1	7	
2015	IAA	UK-Ireland FAB	1	287 663	239 322	351 654	0,58	25	1,69	0,28	0,35	0,37	1,00	1,69	1,11	1,13	1,11	0,10	0,37	2,05	0,85	0,44	25,6	0	122,2	1	7	
2005	ENAV	BLUE MED FAB	1	1 006 498	1 175 863	1 310 577	0,21		5,40	0,30	0,54	0,24	1,07	5,80	1,22	1,23	0,66	0,08	0,55	2,41			0,9	2,2	100,4	0	6	
2006	ENAV	BLUE MED FAB	1	1 035 302	1 206 570	1 340 011	0,22		5,33	0,29	0,54	0,23	1,07	5,69	1,22	1,23	0,73	0,09	0,52	2,47			2	2,2	100,1	0	6	
2007	ENAV	BLUE MED FAB	1	1 113 054	1 290 944	1 442 656	0,23		5,66	0,29	0,55	0,24	1,08	6,08	1,22	1,23	0,83	0,10	0,50	2,28			1,5	2	99,5	0	6	
2008	ENAV	BLUE MED FAB	1	1 111 106	1 229 799	1 431 951	0,25		5,62	0,29	0,55	0,22	1,06	5,94	1,23	1,26	0,81	0,10	0,53	2,29	0,85	0,61	-1,1	3,5	99,9	0	6	
2009	ENAV	BLUE MED FAB	1	1 035 626	1 128 421	1 332 441	0,26	74	5,26	0,28	0,55	0,20	1,04	5,47	1,24	1,26	0,75	0,10	0,56	2,27	0,85	0,59	-5,5	0,8	102,1	0	6	
2010	ENAV	BLUE MED FAB	1	1 084 843	1 143 351	1 386 944	0,28	69	5,62	0,27	0,55	0,19	1,02	5,70	1,26	1,29	0,75	0,10	0,55	2,20	0,85	0,54	1,7	1,6	100,1	0	6	
2011	ENAV	BLUE MED FAB	1	1 074 307	1 162 015	1 382 423	0,27	71	5,34	0,28	0,57	0,19	1,04	5,55	1,25	1,28	0,72	0,11	0,56	2,10	0,84	0,53	0,6	2,9	101,5	0	6	
2012	ENAV	BLUE MED FAB	1	1 028 353	1 106 027	1 322 479	0,29	71	5,20	0,27	0,59	0,18	1,04	5,41	1,29	1,30	0,69	0,11	0,56	2,06	0,79	0,60	-2,8	3,3	101,3	0	6	
2013	ENAV	BLUE MED FAB	1	1 001 334	1 050 026	1 280 519	0,31	70	5,34	0,26	0,59	0,17	1,02	5,43	1,29	1,32	0,70	0,11	0,58	2,14	0,78	0,64	-1,7	1,2	102,3	1	6	
2014	ENAV	BLUE MED FAB	1	1 016 435	1 175 749	1 329 980	0,24	72	5,72	0,25	0,60	0,16	1,00	5,73	1,32	1,35	0,73	0,11		2,18	0,77	0,64	0,1	0,2	102,2	1	6	
2015	ENAV	BLUE MED FAB	1	1 004 733	1 126 554	1 330 020	0,22	72	4,42	0,11	0,40	0,10	0,61	2,68	1,58	1,60	0,72	0,11	0,57	2,15	0,76	0,55	1	0,1	100,1	1	6	
2005	LGS	North European FAB	1	53 286	34 520	62 213	0,78		3,04	0,10	0,40	0,12	0,61	1,87	1,12	1,15	0,75	0,02	0,21	4,88			10,7	6,9	56,1	0	1	
2006	LGS	North European FAB	1	58 229	34 214	66 869	0,79		2,87	0,11	0,38	0,13	0,62	1,77	1,16	1,21	0,76	0,02	0,24	4,93			11,9	6,6	62,4	0	1	
2007	LGS	North European FAB	1	63 776	40 533	74 125	0,79		3,19	0,11	0,38	0,13	0,62	1,97	1,13	1,14	0,74	0,03	0,29	4,88			10	10,1	68,4	0	1	
2008	LGS	North European FAB	1	68 782	57 904	83 889	0,74		3,06	0,10	0,43	0,15	0,68	2,08	1,11	1,14	0,83	0,03	0,29	4,83	0,86	0,68	-3,5	15,3	75,6	0	1	
2009	LGS	North European FAB	1	61 023	59 858	76 768	0,71	26	2,99	0,09	0,41	0,14	0,64	1,92	1,11	1,14	0,62	0,02	0,30	4,36	0,90	0,77	-14,4	3,3	74,2	0	1	
2010	LGS	North European FAB	1	62 904	62 847	79 510	0,70	26	2,99	0,10	0,43	0,14	0,68	2,02	1,16	1,17	0,67	0,03	0,30	4,07	0,86	0,81	-3,9	-1,2	68,6	0	1	
2011	LGS	North European FAB	1	72 249	71 583	91 230	0,69	29	3,21	0,09	0,46	0,16	0,71	2,29	1,17	1,18	0,77	0,03	0,30	4,42	0,87	0,83	6,4	4,2	71,2	0	1	
2012	LGS	North European FAB	1	72 741	68 360	90 920	0,71	28	3,23	0,09	0,46	0,18	0,73	2,34	1,16	1,18	0,89	0,04	0,29	4,47	0,85	0,88	4	2,3	71,5	0	1	
2013	LGS	North European FAB	1	73 916	67 242	91 795	0,71	26	3,28	0,09	0,46	0,16	0,70	2,31	1,17	1,19	0,90	0,04	0,27	4,18	0,87	0,90	2,6	0	70,5	1	1	
2014	LGS	North European FAB	1	75 441	65 418	92 886	0,73	26	3,25	0,09	0,48	0,16	0,72	2,35	1,18	1,20	0,72	0,03		3,90	0,88	0,92	1,9	0,7	70,6	1	1	
2015	LGS	North European FAB	1	77 094	67 796	95 222	0,72	25	8,95	0,05	0,46	0,13	0,64	5,72	1,36	1,40	0,88	0,04	0,27	3,85	0,88	0,92	2,8	0,2	68,8	1	1	
2005	Oro navigacija	Baltic FAB	1	31 880	37 516	41 582	0,69		2,00	0,11	0,43	0,16	0,69	1,39	1,13	1,16	0,37	0,02	0,36	4,23			7,7	2,7	53,2	0	5	
2006	Oro navigacija	Baltic FAB	1	36 477	38 100	46 099	0,72		2,04	0,15	0,45	0,19	0,78	1,60	1,14	1,15	0,40	0,02	0,40	4,31			7,4	3,8	56,3	0	5	
2007	Oro navigacija	Baltic FAB	1	42 415	41 666	53 053	0,73		2,42	0,15	0,44	0,18	0,78	1,89	1,20	1,22	0,47	0,02	0,37	4,33			11,1	5,8	58,7	0	5	
2008	Oro navigacija	Baltic FAB	1	50 249	46 192	62 300	0,74		2,69	0,12	0,45	0,17	0,73	1,98	1,12	1,15	0,57	0,03	0,34	4,30	0,84	0,97	2,6	11,1	64,3	0	5	
2009	Oro navigacija	Baltic FAB	1	43 052	31 642	51 375	0,80	50	3,18	0,06	0,34	0,13	0,54	1,70	1,11	1,13	0,41	0,03	0,40	3,90	0,88	0,97	-14,8	4,2	65,3	0	5	
2010	Oro navigacija	Baltic FAB	1	47 539	37 718	57 505	0,78	48	2,94	0,07	0,37	0,17	0,62	1,82	1,21	1,24	0,44	0,03	0,40	3,70	0,87	0,96	1,6	1,2	63,1	0	5	
2011	Oro navigacija	Baltic FAB	1	52 480	39 890	63 057	0,80	47	3,08	0,07	0,42	0,18	0,68	2,09	1,15	1,18	0,49	0,04	0,38	3,65	0,86	0,92	6	4,1	64,1	0	5	
2012	Oro navigacija	Baltic FAB	1	51 981	41 903	63 124	0,79	46	3,08	0,07	0,43	0,19	0,69	2,13	1,15	1,16	0,48	0,04	0,40	3,50	0,83	0,91	3,8	3,2	63,4	0	5	
2013	Oro navigacija	Baltic FAB	1	51 095	43 327	62 615	0,80	46	2,86	0,08	0,49	0,15	0,72	2,06	1,17	1,19	0,47	0,04	0,43	3,37	0,82	0,93	3,5	1,2	62,9	1	5	
2014	Oro navigacija	Baltic FAB	1	53 376	48 064	66 194	0,79	41	3,08	0,08	0,47	0,16	0,71	2,19	1,19	1,22	0,49	0,04		3,34	0,81	0,93	3,5	0,2	62,4	1	5	
2015	Oro navigacija	Baltic FAB	1	53 964	50 685	67 516	0,77	43	4,12	0,08	0,27	0,19	0,54	2,22	1,16	1,20	0,49	0,05	0,42	3,44	0,81	0,94	2	-0,7	60,8	1	5	
2005	MATS	BLUE MED FAB	1	32 179	29 105	39 706	0,61		0,97	0,23	0,37	0,13	0,73	0,71	1,24	1,25	0,42	0,02	0,33	3,24			3,8	2,5	72,1	0	2	
2006	MATS	BLUE MED FAB	1	33 376	27 548	40 333	0,64		0,98	0,20	0,37	0,12	0,70	0,69	1,20	1,21	0,42	0,02	0,33	3,20			1,8	2,6	74,9	0	2	
2007	MATS	BLUE MED FAB	1	37 583	30 166	45 285	0,63		1,00	0,15	0,36	0,11	0,62	0,62	1,21	1,23	0,54	0,03	0,33	3,67			4	0,7	74,5	0	2	
2008	MATS	BLUE MED FAB	1	40 891	30 094	48 742	0,65		1,03	0,12	0,35	0,11	0,58	0,60	1,22	1,28	0,49	0,02	0,29	2,90	0,76	0,38	3,3	4,7	77,4	0	2	
2009	MATS	BLUE MED FAB	1	41 346	29 115	49 004	0,66	27	1,04	0,12	0,37	0,12	0,62	0,64	1,23	1,26	0,47	0,02	0,31	2,61	0,77	0,34	-2,5	1,8	79,6	0	2	
2010	MATS	BLUE MED FAB	1	46 587	32 804	55 255	0,66	25	1,18	0,11	0,36	0,12	0,59	0,70	1,24	1,28	0,55	0,02	0,26	2,50	0,81	0,37	3,5	2	78,1	0	2	
2011	MATS	BLUE MED FAB	1	52 190	33 445	61 058	0,59	28	1,55	0,08	0,37	0,17	0,62	0,97	1,11	1,46	0,73	0,03	0,26	2,98	0,73	0,13	1,4	2,5	79,2	0	2	
2012	MATS	BLUE MED FAB	1	61 297	33 119	70 104	0,66	21	1,43	0,08	0,37	0,15	0,59	0,85	1,28	1,36	0,67	0,02	0,21	3,02	0,88	0,31	2,6	3,2	78,8	0	2	
2013	MATS	BLUE MED FAB	1	67 975	35 565	77 431	0,67	20	1,66	0,07	0,37	0,19	0,63	1,05	1,20	1,25	0,87	0,04	0,20	2,67	0,86	0,48	4,6	1	81,4	1	2	
2014	MATS	BLUE MED FAB	1	67 652	38 425	77 899	0,62	22	1,78	0,06	0,36	0,23	0,65	1,16	1,21	1,31	0,72	0,03		2,78	0,87	0,78	8,2	0,8	80,8	1	2	
2015	MATS	BLUE MED FAB	1	76 832	41 893	88 034	0,59	18	2,93	0,21	0,51																	

Year	ANSPs	FAB	OSANS P	TFH	IFRA	CFH	STF	EDUR	ATD	r_VDIF	r_HDIF	r_SDIF	STC	ATC	TVM	TVW	ATCOH P	ATCOE C	FGTGC E	SSR	SANSP R	FLANS P	RGDP	IR	CPL	FAB	FAB_Y	PART
2014	MoldATSA		1	13 110	19 359	18 273	0,66		1,50	0,04	0,44	0,15	0,63	0,94	1,43	1,49	0,17	0,03		4,71	0,65	0,92				0	1	0
2015	MoldATSA		1	10 570	22 612	16 616	0,50		3,27	0,09	0,49	0,20	0,77	2,54	1,16	1,18	0,15	0,01	0,50	4,29	0,49	0,76				0	1	0
2005	LVNL	FABEC	1	139 669	467 208	260 490	0,14		9,19	0,25	0,37	0,32	0,94	8,66	1,09	1,11	0,83	0,08	0,89	4,96			2,2	1,5	101,81		0	3
2006	LVNL	FABEC	1	150 485	487 332	273 557	0,14		9,22	0,24	0,37	0,33	0,94	8,67	1,10	1,11	0,99	0,09	0,78	5,53			3,5	1,6	101,11		0	3
2007	LVNL	FABEC	1	152 465	503 965	281 137	0,14		9,38	0,24	0,36	0,34	0,95	8,94	1,07	1,09	0,97	0,10	0,77	5,37			3,7	1,6	99,51		0	3
2008	LVNL	FABEC	1	152 085	495 565	281 374	0,13		9,98	0,25	0,37	0,32	0,94	9,39	1,10	1,12	0,88	0,12	0,81	5,31	0,74	-0,14	1,7	2,2	102,41		0	3
2009	LVNL	FABEC	1	142 442	452 659	261 508	0,15	74	9,60	0,24	0,38	0,34	0,96	9,21	1,09	1,11	0,91	0,12	0,93	5,24	0,74	-0,32	-3,8	1	106,51		0	3
2010	LVNL	FABEC	1	144 099	449 558	262 883	0,15	68	9,91	0,21	0,36	0,36	0,94	9,33	1,12	1,13	0,90	0,13	0,84	4,90	0,73	-0,24	1,4	0,9	107,61		0	3
2011	LVNL	FABEC	1	155 347	485 525	284 087	0,08	60	10,20	0,20	0,41	0,35	0,96	9,78	1,10	1,10	0,94	0,14	0,74	4,71	0,75	-0,13	1,7	2,5	108,91		0	3
2012	LVNL	FABEC	1	149 594	483 300	278 118	0,13	62	9,80	0,18	0,43	0,36	0,97	9,47	1,10	1,12	0,89	0,16	0,77	4,47	0,77	-0,04	-1,1	2,8	107,91		0	3
2013	LVNL	FABEC	1	150 968	485 438	280 038	0,13	58	9,91	0,19	0,43	0,38	1,00	9,91	1,10	1,12	0,88	0,16	0,64	4,39	0,70	0,05	-0,2	2,6	108,91		1	3
2014	LVNL	FABEC	1	153 540	496 588	285 969	0,13	59	10,20	0,18	0,43	0,39	1,00	10,19	1,11	1,11	0,85	0,15		5,04	0,66	0,14	1,4	0,3	109,71		1	3
2015	LVNL	FABEC	1	158 229	506 076	293 545	0,14	55	9,13	0,08	0,44	0,16	0,68	6,18	1,35	1,39	0,78	0,12	0,62	4,92	0,68	0,26	2,3	0,2	108,31		1	3
2005	Avinor (Continental)	North European FAB	1	287 845	572 469	435 886	1,00		1,62	0,36	0,47	0,30	1,14	1,85	1,11	1,12	0,60	0,07	0,30	2,04			2,6	1,5	139,91		0	4
2006	Avinor (Continental)	North European FAB	1	293 320	606 202	446 411	1,00		1,80	0,36	0,49	0,29	1,14	2,05	1,10	1,11	0,69	0,07	0,34	2,54			2,4	2,4	138,31		0	4
2007	Avinor (Continental)	North European FAB	1	305 119	627 054	465 218	1,00		2,05	0,36	0,49	0,28	1,12	2,30	1,10	1,12	0,73	0,10	0,41	2,73			3	0,8	134,71		0	4
2008	Avinor (Continental)	North European FAB	1	314 523	634 609	480 087	1,00		2,19	0,37	0,49	0,25	1,11	2,43	1,12	1,14	0,76	0,08	0,38	2,81	0,56	13,49	0,5	3,4	1381		0	4
2009	Avinor (Continental)	North European FAB	1	302 927	601 428	461 124	1,00	63	2,07	0,35	0,48	0,26	1,10	2,27	1,10	1,12	0,78	0,09	0,37	2,81	0,51	0,00	-1,7	2,3	135,21		0	4
2010	Avinor (Continental)	North European FAB	1	310 002	603 185	469 378	1,00	58	2,03	0,33	0,47	0,25	1,04	2,12	1,12	1,14	0,75	0,10	0,39	2,73	0,52	0,00	0,7	2,3	1491		0	4
2011	Avinor (Continental)	North European FAB	1	330 489	654 572	504 053	1,00	55	2,08	0,31	0,48	0,27	1,06	2,21	1,11	1,12	0,79	0,12	0,40	2,57	0,52	0,00	1	1,3	155,51		0	4
2012	Avinor (Continental)	North European FAB	1	347 816	674 187	527 103	1,00	51	2,12	0,29	0,48	0,26	1,04	2,20	1,10	1,13	0,84	0,13	0,41	2,40	0,50	0,00	2,7	0,4	160,21		0	4
2013	Avinor (Continental)	North European FAB	1	367 881	690 446	551 460	1,00	52	2,18	0,28	0,46	0,25	0,99	2,17	1,12	1,14	0,87	0,13	0,43	2,56	0,52	1,00	1	2	156,11		1	4
2014	Avinor (Continental)	North European FAB	1	376 179	699 114	562 617	1,00	45	2,21	0,27	0,46	0,26	0,99	2,18	1,10	1,13	0,89	0,13		2,42	0,52	0,21	2	1,9	147,41		1	4
2015	Avinor (Continental)	North European FAB	1	368 391	673 588	548 497	1,00	44	10,27	0,19	0,43	0,41	1,03	10,60	1,11	1,13	0,93	0,09	0,37	2,51	0,54	0,40	2	2	138,31		1	4
2005	PANSA	Baltic FAB	1	254 259	216 795	310 322	0,46		3,35	0,15	0,49	0,25	0,89	2,97	1,16	1,18	0,75	0,05	0,30	3,27			3,5	2,2	59,31		0	6
2006	PANSA	Baltic FAB	1	286 338	269 308	354 350	0,44		3,37	0,15	0,49	0,24	0,87	2,94	1,16	1,18	0,82	0,05	0,30	3,15			6,2	1,3	60,91		0	6
2007	PANSA	Baltic FAB	1	319 705	296 236	395 340	0,45		3,56	0,14	0,51	0,22	0,87	3,08	1,15	1,16	0,86	0,06	0,33	4,20			7	2,6	60,71		0	6
2008	PANSA	Baltic FAB	1	348 322	307 573	428 565	0,48		3,87	0,14	0,53	0,22	0,88	3,40	1,17	1,20	0,93	0,09	0,40	4,34	0,83	0,81	4,2	4,2	67,41		0	6
2009	PANSA	Baltic FAB	1	324 966	283 303	399 485	0,49	34	3,75	0,13	0,51	0,22	0,87	3,25	1,15	1,16	0,87	0,07	0,34	4,39	0,82	0,75	2,8	4	57,11		0	6
2010	PANSA	Baltic FAB	1	346 269	288 339	422 455	0,51	32	4,28	0,14	0,52	0,25	0,92	3,92	1,20	1,20	0,91	0,08	0,35	4,19	0,81	0,69	3,6	2,6	59,61		0	6
2011	PANSA	Baltic FAB	1	381 898	298 342	461 006	0,54	31	4,57	0,14	0,51	0,25	0,91	4,13	1,19	1,19	0,97	0,10	0,35	4,01	0,80	0,67	5	3,9	57,71		0	6
2012	PANSA	Baltic FAB	1	401 752	324 379	488 014	0,52	32	4,74	0,14	0,52	0,24	0,90	4,26	1,21	1,24	0,97	0,10	0,34	3,88	0,83	0,66	1,6	3,7	55,71		0	6
2013	PANSA	Baltic FAB	1	402 743	309 981	485 162	0,54	30	4,79	0,14	0,54	0,22	0,89	4,26	1,21	1,24	0,91	0,10	0,34	3,63	0,83	0,60	1,4	0,8	55,71		1	6
2014	PANSA	Baltic FAB	1	408 597	317 128	493 168	0,54	35	4,72	0,14	0,53	0,22	0,89	4,21	1,24	1,26	0,90	0,10		3,63	0,84	0,54	3,3	0,1	55,81		1	6
2015	PANSA	Baltic FAB	1	403 032	328 185	490 783	0,52	33	2,63	0,04	0,29	0,16	0,49	1,30	1,19	1,28	0,89	0,10	0,37	3,69	0,82	0,53	3,8	-0,7	54,21		1	6
2005	NAV Portugal (Continental)	South West FAB	1	235 519	235 540	296 430	0,37		3,28	0,14	0,40	0,08	0,61	2,01	1,10	1,12	0,84	0,11	0,49	3,71			0,8	2,1	79,31		0	1
2006	NAV Portugal (Continental)	South West FAB	1	251 955	250 525	315 223	0,37		3,38	0,15	0,39	0,08	0,62	2,10	1,09	1,10	0,84	0,11	0,45	3,69			1,6	3	79,31		0	1
2007	NAV Portugal (Continental)	South West FAB	1	267 855	268 392	336 381	0,36		3,64	0,16	0,41	0,08	0,64	2,34	1,09	1,09	0,95	0,10	0,45	3,65			2,5	2,4	81,51		0	1
2008	NAV Portugal (Continental)	South West FAB	1	276 148	274 375	347 730	0,37		3,77	0,16	0,40	0,07	0,63	2,38	1,12	1,12	0,96	0,13	0,47	3,66	0,81	0,30	0,2	2,7	84,31		0	1
2009	NAV Portugal (Continental)	South West FAB	1	258 915	258 820	326 994	0,36	49	3,35	0,17	0,40	0,08	0,65	2,18	1,13	1,15	0,92	0,13	0,46	3,56	0,81	0,32	-3	-0,9	86,11		0	1
2010	NAV Portugal (Continental)	South West FAB	1	273 612	270 464	345 075	0,36	41	3,42	0,17	0,39	0,08	0,65	2,21	1,14	1,15	0,93	0,12	0,39	3,36	0,85	0,32	1,9	1,4	85,51		0	1
2011	NAV Portugal (Continental)	South West FAB	1	288 109	274 051	360 775	0,39	41	3,71	0,16	0,38	0,08	0,62	2,28	1,13	1,14	0,93	0,16	0,41	3,28	0,83	0,30	-1,8	3,6	861		0	1
2012	NAV Portugal (Continental)	South West FAB	1	284 669	269 298	356 283	0,38	39	3,61	0,16	0,37	0,08	0,61	2,20	1,13	1,15	0,92	0,15	0,41	3,37	0,80	0,29	-4	2,8	84,21		0	1
2013	NAV Portugal (Continental)	South West FAB	1	301 200	274 736	374 248	0,39	35	3,77	0,15	0,37	0,08	0,60	2,27	1,15	1,15	0,96	0,13	0,36	3,37	0,80	0,32	-1,1	0,4	831		1	1
2014	NAV Portugal (Continental)	South West FAB	1	322 038	291 627	399 808	0,39	33	4,23	0,15	0,38	0,08	0,60	2,54	1,16	1,17	1,00	0,11		3,20	0,81	0,34	0,9	-0,2	831		1	1
2015	NAV Portugal (Continental)	South West FAB	1	334 646	308 996	417 267	0,39	32	5,55	0,08	0,44	0,04	0,55	3,07	1,73	1,76	1,02	0,12	0,33	3,12	0,84	0,34	1,8	0,5	821		1	1
2005	ROMATSA	Danube FAB	1	257 286	126 663	290 041	0,69		5,37	0,05	0,32	0,11	0,47	2,53	1,33	1,34	0,35	0,04	0,54	3,53			4,2	9,1	51,11		0	4
2006	ROMATSA	Danube FAB	1	257 301	138 607	292 305	0,67		5,15	0,05	0,33	0,10	0,48	2,46	1,31	1,33	0,35	0,04	0,58	3,52			8,1	6,6	54,61		0	4
2007	ROMATSA	Danube FAB	1	261 452	163 962	303 315	0,62		4,92	0,06	0,34																	

Year	ANSPs	FAB	OSANS P	TFH	IFRA	CFH	STF	EDUR	ATD	r_VDIF	r_HDIF	r_SDIF	STC	ATC	TVM	TVW	ATCOH P	ATCOE C	FGTGC E	SSR	SANSP R	FLANS P	RGDP	IR	CPL	FAB	FAB_Y	PART
2007	SMATSA		1	187 637	63 594	203 874	0,86		7,68	0,05	0,44	0,07	0,57	4,35	1,42	1,44	0,69	0,05	0,40	3,40						0	0	2
2008	SMATSA		1	204 578	67 995	222 317	0,86		8,16	0,05	0,45	0,07	0,58	4,71	1,39	1,41	0,76	0,05	0,34	3,84	0,92	0,70				0	0	2
2009	SMATSA		1	207 800	62 942	224 356	0,88		8,64	0,05	0,46	0,06	0,58	4,94	1,43	1,46	0,74	0,04	0,33	3,79	0,84	0,67				0	0	2
2010	SMATSA		1	216 515	69 612	234 908	0,87		9,04	0,05	0,47	0,06	0,58	5,23	1,40	1,42	0,78	0,05	0,35	3,72	0,85	0,54				0	0	2
2011	SMATSA		1	220 284	69 789	238 789	0,87		8,99	0,04	0,47	0,06	0,58	5,19	1,41	1,43	0,77	0,05	0,39	3,53	0,92	0,53				0	0	2
2012	SMATSA		1	208 537	68 908	226 862	0,87		8,58	0,04	0,49	0,07	0,60	5,14	1,43	1,44	0,75	0,05	0,37	3,48	0,90	0,53				0	0	2
2013	SMATSA		1	199 944	71 785	219 030	0,86		8,52	0,04	0,50	0,06	0,60	5,12	1,48	1,49	0,72	0,05	0,35	3,31	0,93	0,59				0	1	2
2014	SMATSA		1	207 116	82 980	229 245	0,85		8,22	0,04	0,51	0,07	0,62	5,11	1,51	1,51	0,72	0,05		3,09	0,85	0,65				0	1	2
2015	SMATSA		1	224 424	84 454	247 005	0,86		10,62	0,26	0,56	0,18	1,00	10,63	1,12	1,13	0,74	0,05	0,35	3,17	0,89	0,70				0	1	2
2005	LPS	FAB CE	1	70 730	39 044	80 827	0,88		5,20	0,15	0,47	0,18	0,79	4,13	1,33	1,33	0,49	0,04	0,44	4,02			6,8	2,8	54,1	0	0	8
2006	LPS	FAB CE	1	73 016	40 531	83 252	0,88		5,23	0,16	0,50	0,18	0,85	4,42	1,34	1,35	0,51	0,04	0,46	3,99			8,5	4,3	57,5	0	0	8
2007	LPS	FAB CE	1	72 269	43 585	83 397	0,86		4,99	0,16	0,50	0,18	0,84	4,18	1,33	1,35	0,52	0,05	0,46	4,12			10,8	1,9	63,3	0	0	8
2008	LPS	FAB CE	1	78 549	47 545	90 953	0,86		4,94	0,17	0,51	0,19	0,88	4,34	1,33	1,35	0,57	0,05	0,52	4,24	0,85	0,88	5,6	3,9	69,2	0	0	8
2009	LPS	FAB CE	1	75 820	40 382	86 442	0,88	57	5,32	0,15	0,48	0,18	0,82	4,34	1,38	1,39	0,58	0,06	0,59	4,64	0,88	0,89	-5,4	2,5	72,5	0	0	8
2010	LPS	FAB CE	1	81 776	36 336	91 377	0,90	57	6,21	0,14	0,48	0,17	0,78	4,86	1,38	1,40	0,62	0,07	0,60	4,72	0,90	0,85	5	0,7	69,4	0	0	8
2011	LPS	FAB CE	1	84 316	33 565	93 216	0,91	54	6,47	0,12	0,47	0,16	0,75	4,87	1,36	1,38	0,66	0,07	0,61	4,86	0,91	0,85	2,8	4,1	70,1	0	0	8
2012	LPS	FAB CE	1	83 776	29 293	91 566	0,92	56	6,92	0,10	0,48	0,15	0,73	5,08	1,38	1,39	0,65	0,08	0,68	5,00	0,93	0,63	1,7	3,7	69,6	0	0	8
2013	LPS	FAB CE	1	88 438	26 527	95 491	0,93	53	7,79	0,09	0,48	0,15	0,73	5,67	1,37	1,38	0,72	0,09	0,68	5,35	0,94	0,65	1,5	1,5	68,6	1	0	8
2014	LPS	FAB CE	1	92 561	26 590	99 652	0,94	52	8,40	0,08	0,48	0,14	0,71	5,94	1,41	1,49	0,81	0,10		5,77	0,95	0,72	2,8	-0,1	67,8	1	0	8
2015	LPS	FAB CE	1	93 248	30 111	101 299	0,94	49	10,33	0,37	0,45	0,32	1,14	11,74	1,15	1,16	0,77	0,10	0,65	5,57	0,94	0,72	3,9	-0,3	66,2	1	0	8
2005	Slovenia Control	FAB CE	1	32 443	33 867	41 201	0,82		4,45	0,19	0,53	0,21	0,92	4,11	1,39	1,41	0,44	0,06	0,41	2,59			4	2,4	74,6	0	0	6
2006	Slovenia Control	FAB CE	1	33 902	36 173	43 037	0,82		4,44	0,20	0,56	0,21	0,98	4,35	1,39	1,42	0,46	0,06	0,42	2,74			5,7	2,5	75,7	0	0	6
2007	Slovenia Control	FAB CE	1	38 364	42 359	49 179	0,82		5,17	0,20	0,54	0,19	0,92	4,75	1,35	1,38	0,45	0,06	0,45	2,62			6,9	3,8	77,7	0	0	6
2008	Slovenia Control	FAB CE	1	41 043	45 099	52 809	0,82		5,70	0,17	0,50	0,17	0,83	4,75	1,32	1,35	0,46	0,07	0,51	2,56	0,86	0,13	3,3	5,5	81,1	0	0	6
2009	Slovenia Control	FAB CE	1	40 941	40 235	51 524	0,83	71	6,13	0,15	0,49	0,13	0,78	4,76	1,33	1,34	0,40	0,07	0,54	2,39	0,85	0,16	-7,8	0,8	86,6	0	0	6
2010	Slovenia Control	FAB CE	1	43 445	37 134	53 257	0,85	71	7,51	0,15	0,49	0,12	0,76	5,71	1,33	1,37	0,41	0,08	0,56	2,36	0,88	0,17	1,2	2,1	85,3	0	0	6
2011	Slovenia Control	FAB CE	1	47 156	35 308	56 518	0,87	66	8,86	0,13	0,52	0,11	0,76	6,72	1,36	1,39	0,46	0,08	0,58	2,51	0,88	0,13	0,6	2,1	84,4	0	0	6
2012	Slovenia Control	FAB CE	1	48 086	31 619	56 494	0,88	61	9,21	0,12	0,54	0,11	0,77	7,08	1,39	1,41	0,45	0,08	0,56	2,42	0,90	0,21	-2,7	2,8	82,8	0	0	6
2013	Slovenia Control	FAB CE	1	46 133	29 841	54 068	0,88	66	9,29	0,12	0,55	0,10	0,77	7,13	1,43	1,46	0,41	0,08	0,62	2,30	0,89	0,33	-1,1	1,9	83,1	1	0	6
2014	Slovenia Control	FAB CE	1	49 500	28 693	57 152	0,90	60	10,47	0,09	0,54	0,10	0,73	7,63	1,45	1,46	0,44	0,08		2,38	0,86	0,37	3	0,4	81,3	1	0	6
2015	Slovenia Control	FAB CE	1	49 871	31 019	58 165	0,88	62	4,39	0,15	0,40	0,08	0,63	2,75	1,16	1,16	0,45	0,09	0,63	2,49	0,90	0,43	2,3	-0,8	79,5	1	0	6
2005	ENAIRe	South West FAB	1	1 268 914	1 891 583	1 758 080	1,00		5,27	0,20	0,40	0,15	0,75	3,93	1,15	1,16	0,58	0,16	0,57	2,09			3,7	3,4	89,4	0	0	9
2006	ENAIRe	South West FAB	1	1 324 790	1 978 730	1 824 502	1,00		5,44	0,20	0,40	0,13	0,73	3,96	1,15	1,16	0,54	0,17	0,60	2,03			4,2	3,6	89,8	0	0	9
2007	ENAIRe	South West FAB	1	1 420 442	2 114 260	1 960 252	1,00		5,88	0,19	0,40	0,13	0,72	4,25	1,15	1,16	0,55	0,18	0,63	2,02			3,8	2,8	91,8	0	0	9
2008	ENAIRe	South West FAB	1	1 410 456	2 048 406	1 944 868	1,00		5,91	0,19	0,40	0,13	0,73	4,29	1,16	1,17	0,54	0,19	0,68	1,98	0,81	0,24	1,1	4,1	94,6	0	0	9
2009	ENAIRe	South West FAB	1	1 270 178	1 830 254	1 751 600	1,00	94	5,79	0,18	0,40	0,12	0,71	4,11	1,18	1,20	0,52	0,19	0,75	2,06	0,81	0,20	-3,6	-0,2	97,7	0	0	9
2010	ENAIRe	South West FAB	1	1 324 059	1 826 744	1 806 729	1,00	75	6,64	0,17	0,39	0,13	0,69	4,55	1,21	1,22	0,75	0,17	0,59	2,24	0,81	0,27	0	2	97,8	0	0	9
2011	ENAIRe	South West FAB	1	1 388 029	1 854 896	1 879 866	1,00	68	7,03	0,17	0,39	0,13	0,68	4,80	1,20	1,21	0,78	0,16	0,54	2,13	0,79	0,48	-1	3	98,1	0	0	9
2012	ENAIRe	South West FAB	1	1 275 470	1 676 940	1 721 418	1,00	73	6,54	0,16	0,37	0,13	0,67	4,35	1,23	1,24	0,78	0,16	0,59	2,21	0,77	0,48	-2,9	2,4	96,1	0	0	9
2013	ENAIRe	South West FAB	1	1 230 086	1 480 234	1 623 657	0,09	68	6,46	0,15	0,37	0,13	0,64	4,13	1,25	1,26	0,79	0,17	0,56	2,05	0,78	0,57	-1,7	1,5	94,7	1	0	9
2014	ENAIRe	South West FAB	1	1 267 014	1 282 703	1 609 082	0,24	64	6,68	0,14	0,37	0,13	0,64	4,28	1,27	1,28	0,79	0,17		2,07	0,81	0,64	1,4	-0,2	92,7	1	0	9
2015	ENAIRe	South West FAB	1	1 289 298	1 314 027	1 640 648	0,24	61	3,58	0,18	0,57	0,23	0,99	3,54	1,11	1,14	0,79	0,17	0,51	2,12	0,80	0,72	3,4	-0,6	90,7	1	0	9
2005	LFV	Danish-Swedish FAB	1	406 232	550 507	548 594	0,17		3,64	0,23	0,40	0,27	0,90	3,28	1,11	1,14	0,69	0,06	0,26	1,84			2,8	0,8	115,6	0	0	7
2006	LFV	Danish-Swedish FAB	1	420 578	536 633	556 100	0,22		3,57	0,21	0,40	0,26	0,87	3,10	1,12	1,17	0,67	0,06	0,27	1,88			4,7	1,5	113,8	0	0	7
2007	LFV	Danish-Swedish FAB	1	429 813	526 418	564 217	0,26		3,64	0,19	0,41	0,24	0,85	3,10	1,09	1,14	0,70	0,07	0,29	1,94			3,4	1,7	111,1	0	0	7
2008	LFV	Danish-Swedish FAB	1	444 158	550 252	587 714	0,25		3,91	0,21	0,45	0,23	0,89	3,47	1,10	1,16	0,70	0,07	0,29	1,95	0,86	0,86	-0,6	3,3	109,5	0	0	7
2009	LFV	Danish-Swedish FAB	1	399 670	507 838	533 250	0,22	56	3,23	0,21	0,45	0,23	0,89	2,87	1,11	1,12	0,65	0,07	0,32	2,09	0,84	0,89	-5,2	1,9	104,3	0	0	7
2010	LFV	Danish-Swedish FAB	1	402 168	493 534	532 572	0,25	64	3,11	0,22	0,46	0,23	0,91	2,84	1,15	1,15	0,62	0,09	0,40	2,13	0,84	0,04	6	1,9	117,2	0	0	7
2011	LFV	Danish-Swedish FAB	1	430 699	536 236	572 885	0,24	58	3,23	0,23	0,48	0,24	0,95	3,08	1,12	1,14	0,68	0,11	0,38	2,09	0,87							

Year	ANSPs	FAB	OSANS P	TFH	IFRA	CFH	STF	EDUR	ATD	r_VDIF	r_HDIF	r_SDIF	STC	ATC	TVM	TVW	ATCOH P	ATCOE C	FGTGC E	SSR	SANSP R	FLANS P	RGDP	IR	CPL	FAB	FAB_Y	PART
2011	Skyguide	FABEC	0	332 283	490 131	462 244	0,59	74	11,04	0,28	0,60	0,22	1,10	12,14	1,13	1,15	1,07	0,15	0,65	3,86	0,67	0,53	1,7	0,1	154,51	0	5	
2012	Skyguide	FABEC	0	326 811	490 676	457 296	0,58	76	10,70	0,28	0,61	0,23	1,12	11,97	1,15	1,17	1,03	0,16	0,69	3,81	0,67	0,53	1	-0,7	152,71	0	5	
2013	Skyguide	FABEC	0	319 353	477 196	446 232	0,59	73	10,76	0,28	0,61	0,22	1,11	11,98	1,17	1,18	1,00	0,16	0,68	3,88	0,68	0,53	1,9	0,1	147,31	1	5	
2014	Skyguide	FABEC	0	322 705	480 593	450 868	0,59	73	11,19	0,26	0,61	0,22	1,10	12,30	1,16	1,18	1,00	0,16		3,72	0,68	0,53	2,4	0	146,81	1	5	
2015	Skyguide	FABEC	0	325 964	481 066	454 594	0,59	71	4,25	0,14	0,57	0,21	0,92	3,92	1,22	1,23	0,98	0,18	0,78	3,80	0,68	0,53	1,2	-0,8	163,41	1	5	
2005	M-NAV		1	22 077	13 022	25 445	0,88		4,32	0,13	0,47	0,10	0,69	2,99	1,50	1,54	0,32	0,02	0,46	5,17				4,7	44,80	0	1	
2006	M-NAV		1	21 277	13 341	24 646	0,89		5,55	0,09	0,42	0,09	0,60	3,33	1,54	1,58	0,30	0,02	0,47	5,00			5,1		45,70	0	1	
2007	M-NAV		1	20 616	13 294	24 010	0,89		4,72	0,12	0,44	0,07	0,63	2,99	1,57	1,58	0,31	0,02	0,46	5,11			6,5		46,20	0	1	
2008	M-NAV		1	21 409	13 568	24 949	0,89		4,84	0,11	0,42	0,09	0,62	3,02	1,54	1,56	0,27	0,02	0,52	4,71	0,78	0,70	5,5		47,80	0	1	
2009	M-NAV		1	21 090	12 441	24 362	0,90		4,80	0,10	0,40	0,08	0,58	2,78	1,61	1,63	0,25	0,03	0,55	4,13	0,93	0,56	-0,4		47,0	0	1	
2010	M-NAV		1	20 579	12 505	23 883	0,90		4,61	0,11	0,42	0,06	0,59	2,73	1,59	1,62	0,26	0,03	0,51	4,14	0,93	0,82	3,4		46,70	0	1	
2011	M-NAV		1	19 951	11 507	23 002	0,91		4,95	0,09	0,41	0,05	0,55	2,74	1,63	1,69	0,22	0,03	0,52	3,91	0,93	0,85	2,3		48,20	0	1	
2012	M-NAV		1	17 983	11 008	20 910	0,90		4,49	0,10	0,41	0,06	0,57	2,56	1,61	1,67	0,24	0,03	0,49	4,48	0,91	0,87	-0,5		47,50	0	1	
2013	M-NAV		1	17 969	12 032	21 168	0,89		4,17	0,09	0,44	0,06	0,59	2,48	1,69	1,71	0,25	0,03	0,51	4,38	0,90	0,90	2,9		47,60	1	1	
2014	M-NAV		1	24 339	13 565	27 956	0,91		5,45	0,08	0,46	0,04	0,57	3,13	1,69	1,71	0,33	0,04		4,17	0,90	0,90	3,6		46,40	1	1	
2015	M-NAV		1	25 595	15 003	29 607	0,90		7,93	0,04	0,37	0,14	0,55	4,36	1,29	1,34	0,36	0,04	0,43	4,59	0,89	0,89	3,8		45,20	1	1	
2005	DHMI		1	526 813	470 944	648 600	0,23		3,55	0,15	0,34	0,10	0,60	2,14	1,30	1,33	0,63	0,02	0,35	8,28			9		64,90	0	0	
2006	DHMI		1	578 177	517 646	708 904	0,23		3,94	0,15	0,37	0,11	0,62	2,45	1,30	1,31	0,67	0,02	0,35	8,00			7,1		63,90	0	0	
2007	DHMI		1	622 143	568 447	767 278	0,22		4,23	0,16	0,38	0,10	0,64	2,73	1,28	1,28	0,66	0,02	0,33	7,44			5		67,10	0	0	
2008	DHMI		1	674 455	649 155	843 814	0,18		4,46	0,15	0,38	0,11	0,64	2,86	1,29	1,31	0,65	0,02	0,33	6,96	0,67	0,83	0,8		65,50	0	0	
2009	DHMI		1	716 733	682 596	896 279	0,18		4,99	0,14	0,38	0,11	0,62	3,10	1,27	1,29	0,63	0,02	0,31	6,48	0,68	0,87	-4,7		61,20	0	0	
2010	DHMI		1	810 588	806 363	1 023 649	0,14		5,55	0,14	0,38	0,11	0,63	3,51	1,25	1,26	0,74	0,03	0,31	6,03	0,72	0,88	8,5		68,20	0	0	
2011	DHMI		1	903 599	907 286	1 144 171	0,10		6,13	0,14	0,35	0,11	0,60	3,66	1,24	1,27	0,80	0,04	0,32	5,74	0,75	0,89	11,1		60,90	0	0	
2012	DHMI		1	947 628	959 739	1 202 851	0,07		7,49	0,16	0,34	0,15	0,64	4,76	1,24	1,26	0,89	0,05	0,33	5,53	0,75	0,91	4,8		65,0	0	0	
2013	DHMI		1	1 032 828	1 072 991	1 318 120	0,03		8,55	0,16	0,35	0,16	0,67	5,77	1,25	1,26	0,97	0,06	0,32	5,47	0,79	0,91	8,5		63,90	1	0	
2014	DHMI		1	1 195 491	1 173 454	1 508 424	0,05		10,49	0,14	0,31	0,20	0,65	6,84	1,28	1,28	1,04	0,05		5,25	0,76	0,82	5,2		60,0	1	0	
2015	DHMI		1	1 268 412	1 262 415	1 605 962	0,05		11,38	0,26	0,61	0,23	1,10	12,54	1,19	1,19	1,02	0,06	0,30	5,04	0,78	0,87	6,1		61,0	1	0	
2005	UkSATSE		1	243 243	149 845	281 993	0,52		2,30	0,05	0,31	0,12	0,48	1,11	1,18	1,20	0,19	0,01	0,34	4,51					0	0	0	
2006	UkSATSE		1	273 778	165 321	315 528	0,53		2,56	0,05	0,33	0,12	0,50	1,28	1,21	1,23	0,22	0,01	0,44	4,73					0	0	0	
2007	UkSATSE		1	305 700	180 999	351 912	0,52		2,53	0,06	0,35	0,15	0,55	1,39	1,21	1,24	0,28	0,01	0,42	5,23					0	0	0	
2008	UkSATSE		1	333 135	191 868	383 192	0,54		2,73	0,06	0,37	0,16	0,58	1,60	1,23	1,25	0,35	0,01	0,42	6,28	0,86	0,85			0	0	0	
2009	UkSATSE		1	307 591	164 641	350 897	0,56		2,77	0,05	0,36	0,17	0,58	1,60	1,23	1,26	0,30	0,01	0,41	6,41	0,86	0,91			0	0	0	
2010	UkSATSE		1	348 229	185 803	397 323	0,57		3,04	0,05	0,39	0,18	0,62	1,89	1,25	1,26	0,30	0,02	0,45	6,21	0,82	0,89			0	0	0	
2011	UkSATSE		1	371 527	202 638	425 258	0,55		3,02	0,06	0,40	0,18	0,64	1,93	1,26	1,26	0,33	0,02	0,61	6,21	0,85	0,91			0	0	0	
2012	UkSATSE		1	383 542	213 668	440 362	0,54		3,22	0,06	0,39	0,19	0,64	2,06	1,26	1,32	0,34	0,03	0,60	6,17	0,84	0,91			0	0	0	
2013	UkSATSE		1	405 052	208 391	460 460	0,58		3,31	0,06	0,41	0,19	0,66	2,19	1,29	1,30	0,36	0,03	0,57	5,96	0,84	0,94			0	1	0	
2014	UkSATSE		1	253 159	143 155	291 335	0,55		2,75	0,06	0,37	0,17	0,60	1,64	1,38	1,46	0,27	0,02		6,41	0,81	0,96			0	1	0	
2015	UkSATSE		1	153 706	121 191	186 111	0,43		9,68	0,08	0,57	0,10	0,75	7,25	1,43	1,45	0,17	0,01	0,51	5,52	0,69	0,97			0	1	0	
2005	NATS (Continental)	UK-Ireland FAB	0	1 335 030	1 897 138	1 825 631	0,21		9,78	0,40	0,42	0,31	1,13	11,00	1,11	1,12	0,91	0,08	0,43	3,56			3,1	2,1	125,61	0	6	
2006	NATS (Continental)	UK-Ireland FAB	0	1 398 031	2 000 693	1 903 289	0,17		10,41	0,39	0,42	0,30	1,11	11,60	1,11	1,12	0,95	0,10	0,42	3,63			2,5	2,3	124,91	0	6	
2007	NATS (Continental)	UK-Ireland FAB	0	1 449 389	2 022 024	1 965 650	0,19		10,78	0,39	0,42	0,29	1,09	11,80	1,11	1,12	0,95	0,09	0,43	3,59			2,4	2,3	125,91	0	6	
2008	NATS (Continental)	UK-Ireland FAB	0	1 471 343	1 975 173	1 986 650	0,20		11,61	0,40	0,42	0,28	1,10	12,77	1,12	1,14	1,14	0,10	0,37	3,63	0,73	0,24	-0,5	3,6	113,11	0	6	
2009	NATS (Continental)	UK-Ireland FAB	0	1 309 834	1 788 687	1 780 323	0,20	70	10,42	0,38	0,41	0,30	1,09	11,32	1,13	1,14	1,01	0,10	0,39	3,33	0,75	0,33	-4,2	2,2	107,21	0	6	
2010	NATS (Continental)	UK-Ireland FAB	0	1 258 315	1 703 016	1 708 293	0,20	73	9,99	0,37	0,41	0,31	1,09	10,90	1,17	1,18	0,99	0,11	0,42	3,25	0,75	0,32	1,7	3,3	110,81	0	6	
2011	NATS (Continental)	UK-Ireland FAB	0	1 304 342	1 746 362	1 767 400	0,20	68	9,89	0,38	0,44	0,30	1,12	11,05	1,14	1,15	1,00	0,11	0,39	3,12	0,76	0,20	1,5	4,5	111,1	0	6	
2012	NATS (Continental)	UK-Ireland FAB	0	1 291 693	1 730 568	1 751 902	0,20	69	9,81	0,37	0,44	0,30	1,11	10,92	1,14	1,15	0,99	0,12	0,44	3,11	0,76	0,37	1,5	2,8	118,61	0	6	
2013	NATS (Continental)	UK-Ireland FAB	0	1 297 266	1 735 158	1 758 617	0,20	73	9,95	0,37	0,43	0,30	1,11	11,03	1,15	1,16	1,01	0,12	0,46	3,02	0,77	0,41	2,1	2,6	116,51	1	6	
2014	NATS (Continental)	UK-Ireland FAB	0	1 308 524	1 772 434	1 781 191	0,20	65	10,09	0,37	0,44	0,30	1,12	11,28	1,15	1,16	1,03	0,13		2,88	0,77	0,29	3,1	1,5	122,41	1	6	
2015	NATS (Continental)	UK-Ireland FAB	0	1 346 567	1 753 259	1 815 361	0,23	63	9,24	0,04	0,52	0,06	0,62	5,77	1,49	1,53	1,10	0,16	0,51	2,97	0,77	0,42	2,3	0	133,31	1	6	
2005	MUAC	FABEC	1	509 703		509 703	1,00		9,84	0,26	0,50	0,17	0,93	9,13	1,10	1,11	1,65	0,11	0,22	2,74	1,00				1	0	2	
2006	MUAC	FABEC	1	545 661		545 661	1,00		10,38																			

Year	ANSPs	FAB	OSANS P	TFH	IFRA	CFH	STF	EDUR	ATD	r_VDIF	r_HDIF	r_SDIF	STC	ATC	TVM	TVW	ATCOH P	ATCOE C	FGTGC E	SSR	SANSP R	FLANS P	RGDP	IR	CPL	FAB	FAB_Y	PART
2015	MUAC	FABEC	1	600 970		600 970	1,00		2,14	0,08	0,29	0,10	0,48	1,02	1,37	1,39	1,97	0,21	0,23	2,15	1,00					1	1	2

Table 1. ANSPs participation in partnership forms

ANSPs	Country	Country	Name of FAB	Inter-FAB (Yes - 1; No - 0)	Inter-FAB Initiative (Yes - 1; No - 0)	Participation in SU	Participation in SU+SDM (Yes Member - 1; Yes Former member - 0,5; No - 0)	Participation in SU (Yes - 1; No - 0)	Industrial Partnership Alliance (Yes - 1; No - 0)	Industrial Partnership Initiative (Yes - 1; No - 0)	Industrial Partnership Alliance (Yes - 1; No - 0)	Service Provision Partnership ENTRY POINT NORTH Service Provision Partnership (Yes - 1; No - 0)	Service Provision Partnership Nordic Unified Air Traffic Control (NUAC) (Yes - 1; No - 0)	Free Route Airspace establishment or operational cooperation										Partnership in joint undertaking / venture / organisation		
				BOREALIS Alliance (Yes - 1; No - 0)	GATE ONE Initiative (Yes - 1; No - 0)	B4 Consortium	A6 Alliance (Yes Member - 1; Yes Former member - 0,5; No - 0)	NORACON Consortium (terminated in end 2016 early 2017) (Yes - 1; No - 0)	ITEC Alliance (Yes - 1; No - 0)	4-Flight Initiative (Yes - 1; No - 0)	COOPANS Alliance (Yes - 1; No - 0)	ENTRY POINT NORTH Service Provision Partnership (Yes - 1; No - 0)	Nordic Unified Air Traffic Control (NUAC) (Yes - 1; No - 0)	ANSP Cooperation Agreement Danube+Blue Med (Yes - 1; No - 0)	ANSP Cooperation Agreement FAB CE+Blue Med (Yes - 1; No - 0)	ANSP Cooperation Agreement FAB CE+Danube (Yes - 1; No - 0)	South Eastern Europe Night Free Route Airspace (SEEN FRA programme) (Yes - 1; No - 0)	Free Route Airspace cooperation (SEAFRA) (Yes - 1; No - 0)	Free Route Airspace cooperation (SAXFRA) (Yes - 1; No - 0)	Operational and technical cooperation initiative FABEC + SW FAB (Yes - 1; No - 0)	Operational and technical cooperation initiative FABEC+ UK-JRL FAB (Yes - 1; No - 0)	Operational and technical cooperation initiative FABEC+ FABCE (Yes - 1; No - 0)	SESAR Joint Undertaking (SIU) (Yes - 1; No - 0)	SESAR Deployment Manager (SDM) (Yes - 1; No - 0)	FAB CE Aviation Services Ltd (FCE) (Yes - 1; No - 0)	
Albcontrol	Albania	AL	Not in FAB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ANS CR	Czech Republic	CZ	FAB CE	0	1	1	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	1	0	1	
ARMAT S	Armenia	AM	Not in FAB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Austro Control	Austria	AT	FAB CE	0	1	0	1	1	0	0	1	0	0	0	0	1	1	0	0	1	0	1	1	1	1	
Avinor (Continental)	Norway	NO	North European FAB	1	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Belgocontrol	Belgium	BE	FABEC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	
BULATSA	Bulgaria	BA	Danube FAB	0	1	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	
Croatia Control	Croatia	HR	FAB CE	0	1	0	1	0	0	0	1	0	0	0	0	1	1	0	1	0	0	1	1	1	1	
DCAC Cyprus	Cyprus	CY	BLUE MED FAB	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	
DFS	Germany	DE	FABEC	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	
DHMI	Turkey	TR	Not in FAB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
DSNA	France	FR	FABEC	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	
EANS	Estonia	EE	North European FAB	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ENAI RE	Spain	ES	South West FAB	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	
ENAV	Italy	IT	BLUE MED FAB	0	0	0	1	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	1	1	0	
Finavia	Finland	FI	North European FAB	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
HCAA	Greece	GR	BLUE MED FAB	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	
HungaroControl	Hungary	HU	FAB CE	0	1	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	1	0	0	1	
IAA	Ireland	IE	UK-Ireland FAB	1	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	1	0	
LFV	Sweden	SE	Danish-Swedish FAB	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	
LCS	Latvia	LV	North European FAB	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
LPS	Slovak Republic	SK	FAB CE	0	1	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	1	0	1	
LVNL	Netherlands	NL	FABEC	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	
MATS	Malta	MT	BLUE MED FAB	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	
M-NAV	The Former Yugoslav Republic of Macedonia	MK	Not in FAB	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
MoldATSA	Moldova	MD	Not in FAB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
MUAC		MUAC	FABEC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	
NATS (Continental)	United Kingdom	UK	UK-Ireland FAB	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	
NAV Portugal (Continental)	Portugal	PT	South West FAB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	
NAVIAIR	Denmark	DK	Danish-Swedish FAB	1	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	
Oro navigacija	Lithuania	LT	Baltic FAB	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	
PANSA	Poland	PL	Baltic FAB	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	
ROMATSA	Romania	RO	Danube FAB	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Skyguide	Switzerland	CH	FABEC	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	
Slovenia Control	Slovenia	SI	FAB CE	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	1	0	0	1	
SMATSA	Serbia and Montenegro		Not in FAB	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
UkSATSE	Ukraine	UA	Not in FAB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

COOPANS representative CRO Control started participation in A6 from 2015

COOPANS (and former NORACON members) started their participation in A6 from 2011

Skyguide in Joint Consortium with DSNA (for S2020)

B4 Consortium

NORACON members for SESAR1 (stopped at 2016)

Table 2. Years of ANSPs beginning of participation in partnership forms

ANSPs	Country	Country	Name of FAB												Free Route Airspace establishment or operational cooperation										Partnership in joint undertaking / venture / organisation		
															BOREALIS Alliance	GATE ONE Initiative	B4 Consortium	A6 Alliance	NORACON Consortium (terminated in end 2016 early 2017)	ITEC Alliance	4-Flight initiative	COOPANS Alliance	ENTRY POINT NORTH Service Provision Partnership	Nordic Unified Air Traffic Control (NUAC)	ANSP Cooperation Agreement Danube+Blue Med	ANSP Cooperation Agreement FAB CE+Blue Med	ANSP Cooperation Agreement FAB CE+Danube
Albcontrol	Albania	AL	Not in FAB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
ANSCR	Czech Republic	CZ	FAB CE	0	2013	2015	2015	0	0	0	0	0	0	0	2014	2015	0	0	0	0	1	2015	0	2014			
ARMATS	Armenia	AM	Not in FAB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Austro Control	Austria	AT	FAB CE	0	2013	0	2011	011-2014	0	0	2010	0	0	0	2014	2015	0	0	2016	0	0	1	2011	2015	2014		
Avinor (Continental)	Norway	NO	North European FAB	2012	0	0	2011	011-2014	2016	0	0	0	0	0	0	0	0	0	0	0	0	2011	2015	0			
Belgocontrol	Belgium	BE	FABEC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0			
BULATSA	Bulgaria	BA	Danube FAB	0	2013	0	0	0	0	0	0	0	0	2014	0	2015	2017	0	0	0	0	0	0	0			
Croatia Control	Croatia	HR	FAB CE	0	2013	0	2015	0	0	0	2010	0	0	0	2014	2015	0	2016	0	0	1	2015	2015	2014			
DCAC Cyprus	Cyprus	CY	BLUE MED FAB	0	0	0	0	0	0	0	0	0	0	2014	2014	0	0	0	0	0	0	0	0	0			
DFS	Germany	DE	FABEC	0	0	0	2011	0	2007	0	0	0	0	0	0	0	0	0	0	1	1	2011	2015	0			
DHMI	Turkey	TR	Not in FAB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
DSNA	France	FR	FABEC	0	0	0	2011	0	2008	0	0	0	0	0	0	0	0	0	2016	1	1	2011	2015	0			
EANS	Estonia	EE	North European FAB	2012	0	0	011-2014	011-2014	0	0	0	0	0	0	0	0	0	0	0	0	0	011-2014	0	0			
ENAIRE	Spain	ES	South West FAB	0	0	0	2011	0	2007	0	0	0	0	0	0	0	0	0	2016	0	0	0	2015	0			
ENAV	Italy	IT	BLUE MED FAB	0	0	0	2011	0	2008	0	0	0	0	2014	2014	0	0	0	0	0	0	0	2015	0			
Finavia	Finland	FI	North European FAB	2012	0	0	011-2014	011-2014	0	0	0	0	0	0	0	0	0	0	0	0	0	011-2014	0	0			
HCAA	Greece	GR	BLUE MED FAB	0	0	0	0	0	0	0	0	0	0	2014	2014	0	0	0	0	0	0	0	0	0			
HungaroControl	Hungary	HU	FAB CE	0	2013	0	0	0	0	0	0	0	0	0	2014	2015	2017	0	0	0	1	0	0	2014			
IAA	Ireland	IE	UK-Ireland FAB	2012	0	0	2011	011-2014	0	0	2006	2005	0	0	0	0	0	0	0	1	0	2011	2015	0			
LFV	Sweden	SE	Danish-Swedish FAB	2012	0	0	2011	011-2014	0	0	2006	2005	2009	0	0	0	0	0	0	0	0	2011	2015	0			
LGS	Latvia	LV	North European FAB	2012	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
LPS	Slovak Republic	SK	FAB CE	0	2013	2015	2015	0	0	0	0	0	0	0	2014	2015	0	0	0	0	1	2015	0	2014			
LVNL	Netherlands	NL	FABEC	0	0	0	0	0	2011	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0			
MATS	Malta	MT	BLUE MED FAB	0	0	0	0	0	0	2014	0	0	0	2014	2014	0	0	0	0	0	0	0	0	0			
M-NAV	The Former Yugoslav Republic of Macedonia	MK	Not in FAB	0	2015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
MoldATSA	Moldova	MD	Not in FAB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
MUAC	MUAC	MUAC	FABEC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0			
NATS (Continental)	United Kingdom	UK	UK-Ireland FAB	2012	0	0	2011	0	2007	0	0	0	0	0	0	0	0	0	0	1	0	2011	2015	0			
NAV Portugal (Continental)	Portugal	PT	South West FAB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2016	0	0	0	0			
NAVIAIR	Denmark	DK	Danish-Swedish FAB	2012	0	0	2011	011-2014	0	0	2006	2005	2009	0	0	0	0	0	0	0	0	2011	2015	0			
Oro navigacija	Lithuania	LT	Baltic FAB	0	2013	2015	2015	0	2017	0	0	0	0	0	0	0	0	0	0	0	0	2015	0	0			
PANSA	Poland	PL	Baltic FAB	0	2013	2015	2015	0	2017	0	0	0	0	0	0	0	0	0	0	0	0	2015	0	0			
ROMATSA	Romania	RO	Danube FAB	0	2013	0	0	0	0	0	0	0	0	2014	0	2015	2017	0	0	0	0	0	0	0			
Skyguide	Switzerland	CH	FABEC	0	0	0	2015	0	0	2014	0	0	0	0	0	0	0	0	0	1	1	2015	0	0			
Slovenia Control	Slovenia	SI	FAB CE	0	2013	0	0	0	0	0	0	0	0	2014	2015	0	0	2016	0	0	1	0	0	2014			
SMATSA	Serbia and Montenegro		Not in FAB	0	2015	0	0	0	0	0	0	0	0	0	0	0	2016	0	0	0	0	0	0	0			
UKSATSE	Ukraine	UA	Not in FAB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			

ANNEX 7

Table 1. Correlation matrix

Correlation Probability	ATC	ATCOE C	ATCOH P	ATD	CFH	CPL	EDUR	FAB	FAB_Y	FGTGCE	FLANSP	IFRA	IR	OSANSP	PART	R_HDIF	R_SDIF	R_VDIF	RGDP	SANSRPR	SSR	STC	STF	TFH	TVM	TVW
ATC	1.000000																									

ATCOEC	0.381557	1.000000																								
	0.0000	-----																								
ATCOHP	0.243604	0.537327	1.000000																							
	0.0000	0.0000	-----																							
ATD	0.925152	0.330297	0.201511	1.000000																						
	0.0000	0.0000	0.0001	-----																						
CFH	0.434822	0.665074	0.548857	0.385096	1.000000																					
	0.0000	0.0000	0.0000	0.0000	-----																					
CPL	0.074836	0.139891	0.112544	0.058589	0.192685	1.000000																				
	0.1612	0.0089	0.0356	0.2730	0.0003	-----																				
EDUR	-0.142318	0.012806	-0.432388	-0.114351	-0.267984	-0.088066	1.000000																			
	0.0460	0.8582	0.0000	0.1096	0.0001	0.2185	-----																			
FAB	-0.301841	-0.339517	-0.163204	-0.246052	-0.290543	0.180791	-2.99E-23	1.000000																		
	0.0000	0.0000	0.0011	0.0000	0.0000	0.0007	1.0000	-----																		
FAB_Y	0.263874	0.399450	0.189768	0.266131	0.242485	0.008331	-0.335328	-7.19E-17	1.000000																	
	0.0000	0.0000	0.0001	0.0000	0.0000	0.8762	0.0000	1.0000	-----																	
FGTGCE	0.067865	-0.057573	-0.123039	0.036503	-0.113589	0.147440	0.370846	-0.011656	-0.371816	1.000000																
	0.1761	0.2530	0.0143	0.4672	0.0233	0.0057	0.0000	0.8165	0.0000	-----																
FLANSP	-0.054248	-0.017912	0.005044	-0.052322	-0.110992	-0.099904	-0.178143	0.070980	0.059641	-0.046543	1.000000															
	0.3684	0.7666	0.9334	0.3857	0.0651	0.1181	0.0139	0.2390	0.3227	0.4429	-----															
IFRA	0.294721	0.453915	0.319326	0.233360	0.694007	0.119935	0.003729	-0.298938	0.056488	-0.067666	-0.097929	1.000000														
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0244	0.9585	0.0000	0.2652	0.1835	0.1039	-----														
IR	-0.097623	-0.142599	-0.015834	-0.091073	-0.019721	0.154615	0.221342	NA	-0.480122	0.182212	-0.058446	0.175782	1.000000													
	0.0822	0.0113	0.7795	0.1050	0.7261	0.0057	0.0018	NA	0.0000	0.0011	0.3861	0.0017	-----													
OSANSP	0.081024	0.090340	0.117539	0.079938	0.147151	0.126821	-0.032131	-0.115470	-1.08E-17	-0.020942	0.028960	0.056016	0.100064	1.000000												
	0.1048	0.0715	0.0188	0.1095	0.0031	0.0173	0.6540	0.0198	1.0000	0.6766	0.6313	0.2692	0.0748	-----												
PART	-0.245164	-0.162980	-0.121141	-0.197306	-0.303495	-0.034565	0.232699	0.610544	-1.01E-17	0.083071	0.140348	-0.335456	-0.095374	-0.114294	1.000000											
	0.0000	0.0011	0.0155	0.0001	0.0000	0.5180	0.0010	0.0000	0.0975	0.0194	0.0000	0.0895	0.0211	-----												
R_HDIF	0.546414	0.342805	0.252104	0.297003	0.309853	0.063050	-0.123063	-0.246741	0.226334	0.038448	-0.041097	0.173079	-0.111430	0.025456	-0.206404	1.000000										
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2380	0.0849	0.0000	0.0000	0.4437	0.4958	0.0006	0.0471	0.6108	0.0000	-----										
R_SDIF	0.362911	0.303490	0.375270	0.140765	0.432902	0.100237	-0.125875	-0.129104	0.127766	0.012331	-0.052984	0.273154	-0.057689	0.067297	-0.175983	0.568273	1.000000									
	0.0000	0.0000	0.0000	0.0047	0.0000	0.0603	0.0780	0.0096	0.0103	0.8060	0.3797	0.0000	0.3051	0.1781	0.0004	0.0000	-----									
R_VDIF	0.124096	-0.054097	0.148238	-0.049293	0.052874	0.073709	-0.184813	-0.053760	0.002039	0.003994	-0.000612	0.094446	0.014835	0.036040	-0.039881	0.400344	0.535374	1.000000								
	0.0128	0.2810	0.0030	0.3242	0.2903	0.1676	0.0093	0.2822	0.9675	0.9366	0.9919	0.0621	0.7922	0.4712	0.4252	0.0000	0.0000	-----								
RGDP	0.048891	0.071471	0.119085	-0.018949	0.130494	-0.108939	-0.135909	-0.184327	0.036768	-0.101257	0.003429	0.205831	0.146498	0.014400	-0.051924	0.097958	0.284544	0.161281	1.000000							
	0.3604	0.1828	0.0261	0.7231	0.0143	0.0411	0.0569	0.0005	0.4917	0.0584	0.9573	0.0001	0.0089	0.7878	0.3314	0.0664	0.0000	0.0024	-----							
SANSRPR	-0.057120	0.073960	-0.002851	0.014020	0.098930	0.047416	0.233813	-0.126797	0.001577	-0.036603	-0.005486	0.017512	-0.000764	0.022298	-0.074291	-0.181828	0.024056	-0.047627	0.171142	1.000000						
	0.3258	0.2030	0.9609	0.8095	0.0882	0.4500	0.0009	0.0286	0.9784	0.5312	0.9276	0.7677	0.9908	0.7015	0.2010	0.0016	0.6792	0.4127	0.0060	-----						
SSR	-0.095564	-0.125655	0.134163	-0.087388	-0.244911	-0.014797	-0.132439	0.091784	-0.146807	0.173344	0.126598	-0.356433	0.028893	0.086015	0.042086	0.003573	-0.103435	-0.019658	-0.105877	-0.329302	1.000000					
	0.0556	0.0120	0.0073	0.0801	0.0000	0.7821	0.0636	0.0660	0.0032	0.0005	0.0352	0.0000	0.6077	0.0850	0.4000	0.9431	0.0382	0.6944	0.0472	0.0000	-----					
STC	0.442844	0.267563	0.314284	0.167140	0.325017	0.077133	-0.149067	-0.215982	0.114107	0.038203	-0.033810	0.234956	-0.035814	0.073012	-0.186629	0.829856	0.852745	0.718659	0.232695	-0.095643	-0.029716	1.000000				
	0.0000	0.0000	0.0000	0.0008	0.0000	0.1487	0.0366	0.0000	0.0221	0.4467	0.5753	0.0000	0.5245	0.1439	0.0002	0.0000	0.0000	0.0000	0.0000	0.0994	0.5525	-----				
STF	-0.089283	-0.086939	-0.100060	-0.082331	-0.156222	0.049100	0.040575	0.151270	0.004489	0.108198	0.049016	-0.484024	-0.085412	0.101655	0.104030	0.047008	-0.089295	-0.083470	-0.247699	-0.207940	0.543185	-0.052882	1.000000			
	0.0738	0.0828	0.0458	0.0993	0.0017	0.3584	0.5713	0.0024	0.9285	0.0307	0.4165	0.0000	0.1285	0.0416	0.0371	0.3472	0.0737	0.0947	0.0000	0.0003	0.0000	0.2902	-----			
TFH	0.430026	0.657644	0.559273	0.385290	0.985319	0.198465	-0.292107	-0.270006	0.246751	-0.104869	-0.096678	0.572280	-0.045057	0.158184	-0.276803	0.317236	0.441014	0.028163	0.105939	0.113690	-0.198677	0.320292	-0.065134	1.000000		
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0000	0.0000	0.0000	0.0363	0.1084	0.0000	0.4233	0.0015	0.0000	0.0000	0.0000	0.5734	0.0470	0.0499	0.0001	0.0000	0.1925	-----		
TVM	-0.006641	0.092969	-0.092210	0.074171	-0.146219	0.024609	-0.064861	0.037598	0.273162	-0.073895	0.057116	-0.120081	-0.170085	-0.084204	-0.017924	-0.021756	-0.317959	-0.414884	-0.065832	-0.037573	-0.004927	-0.287260	0.101658	-0.136613	1.000000	
	0.9898	0.0636	0.0658	0.1377	0.0033	0.6454	0.3652	0.4522	0.0000	0.1406	0.3436	0.0175	0.0023	0.0918	0.7201	0.6636	0.0000	0.0000	0.2179	0.5182	0.9216	0.0000	0.0416	0.0061	-----	
TVW	-0.031073	0.105095	-0.023434	0.048087	-0.120243	0.000923	-0.051586	0.039524	0.263885	-0.093366	0.064700	-0.136933	-0.190430	-0.073204	-0.052420	-0.049036	-0.294493	-0.448861	-0.073145	-0.028937	0.012799	-0.312518	0.103223	-0.103636	0.947760	1.000000

Correlation Probability	ATC	ATCOE C	ATCOH P	ATD	CFH	CPL	EDUR	FAB	FAB_Y	FGTGCE	FLANSP	IFRA	IR	OSANSP	PART	R_HDIF	R_SDIF	R_VDIF	RGDP	SANSPR	SSR	STC	STF	TFH	TVM	TVW
	0.5344	0.0359	0.6407	0.3362	0.0159	0.9862	0.4716	0.4294	0.0000	0.0624	0.2832	0.0067	0.0006	0.1429	0.2944	0.3267	0.0000	0.0000	0.1709	0.6188	0.7981	0.0000	0.0386	0.0378	0.0000	-----