Aviation Environmental Impact In Europe after Low cost Airlines expansion – Challenges and alternative options

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1. Introduction

“We need transportation as reliable as running water.” It is a phrase coming out of Travis Kalanick’s mind, founder of Uber and Red Swoosh, which in fact consists an aptly description of the main purpose of this dissertation. Except underlining the necessity of uninterrupted operation of transportation, what also this work is trying achieve is the sustainable character new technologies are obliged to maintain. Technology of that kind is the aviation related one, which along with its environmental impact will be the under analysis subject.

It is easy to get lost between legislative schemes, historic changes and political decisions related to transportation issues. In the first half of the below written paragraphs there is a concentrated description of the so far progress which puts the reader in a position to follow easier the flow of facts and understand specified definitions. Approaching current status of aviation environmental impact and green actions, the second part of the theoretical body analyses the so far implemented and upcoming instruments and measures of mitigating environmental devastation. Targets and plans of states and private bodies are also under discussion in this part.

Actions, regulations and freedoms provided to aviation sector excuse the intense growth of the aircrafts traffic and its immediate consequences during the last 30 years. Trends and passengers’ habits or preferences accompany text’s claims to lead the reader to safer conclusions. After all that macroscopic analysis of aviation development and traffic growth, there is a microscopic approach to the subsector of Low Cost Carriers, who tend to change completely the balances in terms of provided services and corresponding price, air traffic and new prospects for transportation. Probably, their operations and dominance- initially in the US and later in European territory concerning almost the half of the travelling population- is the most positive factor in aviation expansion.

This exact expansion initiated by the technological progress and new, modernized corporation model, generates questions whether the sector does the best for its own benefit and for the environment as well. Environment is expected to be burdened by aviation sector multiply in the next years. These results are presented to the reader in this part of the dissertation besides with an effort to ask themselves if they need that much of consumption or what their alternatives are.

At the last part, there will be a research inducted via questionnaires, distributed via e-mail and social media posts to a random population group, only adults and of an education level of bachelor degree or higher. Vast majority of the participants are frequent travelers and the basic pylons of the questions are testing their correlation with aviation related issues, environmental devastation and personal responsibility as consumers. What is being tested by the research is
public opinion about the current green actions of the sector and if it would preferable and viable to seek for alternative solution to other means of transport rather than wait for technological progress to optimize the offered product. There is a statistical analysis of the questions indicating critical thought of the participants in combination with their demographic characteristics concluding to the extraction of some basic statistical results that characterize our sample. Provided answers are also analyzed statistically via Office Excel and there is also a part showing whether there is statistical significance or not between specific characteristics and corresponding answers. The last part of the questionnaire gives the chance to the participant to express personal, unbiased opinion if they should do or have already done what they should as responsible consumers against the environment, in a form of open question.

Contents of the next pages have a concrete base of theoretical background sourcing by scientific research, official publications, relative articles in papers and official websites of recognized operators that protect the validity of the claims and opinions expressed.
2. Regulations and legal background

2.1 Domestic level

Aviation’s impact on climate and the elimination of it consists one of the most challenging tasks for the sector to accomplish. The discussion of aviation environmental impact brings unintentionally to most people's mind only the emissions produced by the activity of aircrafts. Air pollution is definitely one of the most significant parts, but there is also the noise pollution, ground deformation, aircraft recycling and natural environment changes an airport or air traffic causes to specific areas.

The macroscopic approach to this aspect is to consider it as part of the greater human environmental devastation. In this case, the whole problem is covered by the UNFCC (United Nations Framework Convention on Climate Change) and Paris agreement, which treats the problem of greenhouse gas emissions, produced by human activity and specifies how protocols and agreements of international level would deal or be negotiated with UNFCC object. The two previous agreements force their parties-states to deal with the climate change problems in a domestic level, find ways to operate more efficiently and reduce their GHG emissions from their industrial activity. UNFCCC initiated at 1992 and counts 197 parties as of 2015. Later at 1997, the Kyoto Protocol was concluded, came into force in 2005 and adopted by developed countries (ANNEX I) who agreed to obligatory stabilize their GHG emissions produced by any kind of industrial operation, in the period 2008-2012. There are several other conventions, treaties and bilateral or collateral agreements at international level that obligate parties to follow directions relevant to environmental encumbrance regarding their territories. However, no other legislative document exists that concerns at international level aspects of that kind and is applied worldwide.

2.2 Industrial Level

If the problem of aviation environmental impact is examined as a single industrial depending issue, then someone has to go back to Chicago convention. In 1944, December 7th, the International Civil Aviation Organization was established by this convention – same date as the Chicago convention was signed, where general principles and rules for airspace, air transportation and aircraft operation were agreed. Part of the convention refers to the noise pollution generated by aircrafts near the vicinity of airports (ANNEX 16 vol I) and found its appliance to the propeller equipped aircrafts that started being upgraded to more effective but noisy models, while later the introduction of jet engines made the problem even bigger and serious. The side of aircraft engines emissions is covered by ANNEX 16 vol II, which includes details about limitation of emission levels and documentation rules in order the impact to be controlled effectively and interested parts to improve their technology applied for environment’s profit. The Chicago convention has since then been revised 8 times. What has to be cleared is that the Annexes supporting this convention do not have the same obligatory character as the
Convention as they are not in the same level of validity internationally. They just recommend and clarify procedures and standards (SARPs) in order nations included in ICAO to follow a common or similar line (197 parties as of November 2017, which is practically all UN except Dominica, Cook Islands and Lichtenstein under Switzerland’s ratification). Despite the advisory character of the SARPs, in a regional level there are countries that have given a binding power with legal form to Annexes and SARPs’ content for all related parts operating inside their territory.

Since 1983, ICAO environmental protection actions have been supported by CAEP. “The Committee on Aviation Environmental Protection (CAEP) is a technical committee of the ICAO Council, assisting the Council in formulating new policies and adopting new Standards and Recommended Practices (SARPs) related to aircraft noise and emissions, and more generally to aviation environmental impact”, according to ICAO’s definition. It, practically, undertakes all necessary and recommended by ICAO studies needed to address, measure and mitigate noise, aircraft operations and environmental problems emanating by aviation activity. Parallel to this, it organizes all decisions and measures needed to be applied in order to eliminate devastating results of airports and aircrafts’ operation, both to their regional and wider environment.

Examination of each Civil Aviation Authority’s and aircraft operator’s results, reporting and documentation revealed that different regional legislation led to different measurement criteria consideration and, thus, not a corresponding picture to real numbers and size of problems for everyone. (IATA, 2018) Except the necessity of an objective and common way for measurement by any active part of aviation, the real problem could not be faced in an efficient way if not a
market-based measure was applied according to ICAO’s investigation. Advanced technologies implemented on aircrafts and infrastructure, fuels and operational procedures express solution for the long term horizon of the environmental impact mitigation (IATA, 2018). They are the most significant targets to achieve for sustainable the development of aviation, but are also the most expensive and time consuming aims. Recent incomers of aircrafts seem to be much more efficient in terms of energy and spatial exploitation, noise production and fuel consumption, but new technologies also need huge capital sources and time to be adopted and used by airlines and airport operators. (Anastasia Kharina, August, 2015) Regarding alternative, more eco-friendly fuels, they also need to pass through a maturity stage before being implemented to the market and wide use, while they are directly related to the abovementioned technological development.

The need of an effective measure to mitigate the environmental impact of aviation had become urgent. After several but not holistic, organized tests and applications measures taken in local climax, ICAO came to a conclusion for an international agreement. Before introducing the reader to the CORSIA, what has to be cleared is the definitions of carbon offsetting

2.3 Implemented tools – Carbon offsetting and taxation

Carbon offsetting is the way for companies or states to compensate for their carbon emissions by purchasing credits that are used to develop other actions or technologies neutralizing or absorbing CO₂ from the atmosphere. (The Guardian, 2011) What is done is that individuals buy emission units corresponding to their pre-calculated CO₂ fuel emission. In a second phase, they put their customers into that corporate action to buy for themselves those units, having the chance to equalize their per person production of air pollution for a single travel. This is a more specified definition of carbon offsetting for airline industry. A given, typical price for a unit of carbon offsetting is 8£ for 1 tone of CO₂ while one typical British family would have to pay about 45£ in total for their carbon emissions for a return trip from London to New York. (The Guardian, 2011)

In October 2016, ICAO implemented CORSIA (Carbon Offsetting and Reduction Scheme for International Aviation) with its 39th ICAO’s Assembly which between others, focuses its first three chapters to standardized, continuous measures and practices for emission reduction, climate change and noise pollution and mitigation respectfully (Resolutions 39-1, 39-2 and 39-3). Aviation is determined to achieve its targets for technological and fuel consumption improvement. CORSIA is the instrument to achieve these targets for the short and medium term period. Its purpose is to achieve the carbon neutral growth by 2020 and so on as far as international aviation is concerned. Except measurement, reporting standards and procedures for its members, CORSIA also includes a criteria list for its offsetting solutions which guarantee the sustainability, high level of their service and sufficient supply for the interested parts. CORSIA counts 66 state members, having declared their participation voluntarily since 2016 representing approximately 85% of the total international aviation activity. As CORSIA is a new, not yet fully implemented measure, ICAO decided the phase off introduction of it. From 2021 to 2023 will be the pilot phase and from 2024 to 2026 will be the 1st phase of the scheme. In more details,
CORSIA refers to international flights only whose origin and destination are CORSIA parts, as for domestic ones each state has its own rules and commitment requirements. Airline companies are obligated to calculate their annual carbon emissions and then report respectfully to their responsible Civil Aviation Authority. ICAO then collects the related data and calculates a growth factor of the sector, which is again used by aviation operators to calculate their offsetting units corresponding to their carbon footprint.

Only the fact that a considerable part of regulation and legislation of aviation is devoted to confrontation of aircraft noise pollution, highlights the critical role of the problem. Its particularity is that it interferes only with the airport facilities and aircrafts or contractors operating in or near their territory. ANNEX 16 and its initial version, as referred above, dealt with the first type, propeller equipped aircrafts, and after several revisions, still consists a separate category of ICAO’s rules and principles. Since 1971 when firstly ICAO introduced its international standards, they have become more strict and targeted, after have been revised every few years. In particular, in 2014, reduction of 7 Effective Perceived Noise Decibels was set as the aim of the new standard adopted and compared to the current Chapter 4 Standard. Its appliance is expected by 2018. Other ICAO practices for aircraft noise mitigation are included in Resolution A33-7 of ICAO for Balanced Approach to Aircraft Noise management (2001), whose main principle is that as different is each airport from another, the same differentiation should exist to practices and solutions applied to mitigate the noise production. (ICAO, 2001)

There are four pillars that support noise restriction near the vicinity of airport: reduction at source, land-use management and planning, noise abatement of operational procedures and operating restrictions. (IATA, 2018) The last one is and the least preferred solution suggested by ICAO, as the limitation of access to airports has much more negative effect if someone considers the results on passengers’ activities, local economies and airlines healthy operation. Only the first three have been applied properly and still do not insist sufficient solutions, ICAO suggest the operating restrictions and again under specific terms as per Assembly resolution 39-1, 33-7 and EPNdB defines.

Taxes applied on aviation sector relative to their environmental affection is a measure used by states to generate income – or additional income by airlines and airports - but not really mitigate the environmental issues coming from such corporate activities. That is a strong claim of IATA and one of the basic ICAO Policies which declares that taxation has no positive impact on environment but brings a detrimental effect on jobs, competitiveness and economy (ICAO, 2012). In fact, no real positive impact for environment comes by legal schemes aiming to assess charges and costs to companies, but only those who target the limitation of emission production. Except the policies reported in Doc 9082, ICAO also opposes to any king of tax overruns to aviation sector and its customers while the scope of these taxes, that are already applied, should not be related to fiscal targets. (IATA, 2018)

According to surveys conducted by Fariba E Alamdari and Damian Brewer, reaction of airline companies to taxation increase regarding their environmental impact of operation was more likely to increase fares and cut labor costs rather than improve engines’ technology and maintain a more efficient fleet (Fariba E Alamdari, 1994). In relation to this, any kind of current taxation should be implemented to force airlines and operators to improve their greener actions.
instead of their corporative ones, in order to gain profits in long time term and receive motives from states to keep up with eco-friendlier activities and development of the sector. The general rationale against taxation and fines, both for emissions and noise pollution should be to maintain a character of reinvestment. If it is a necessity to be implemented by states, then capitals coming from airlines and airport users’ taxation, should be spent for purposes of research and development of ways that mitigate pollution, enhance technological research and faster adoption it, in order to improve environmental condition and eliminate the sector’s impact to minimum.
3. Aviation traffic Growth and environmental impact

3.1 Introduction

Globally, air transportation has met a huge success over the last 30 years. Numbers of official sources such ICAO’s documentation and EU lead to safe conclusion that hand in hand with the technological progress and networks improvement in terms of speed and competition, the industry of aviation draws a concrete, increasing trend line. No matter of political threats, social upheaval, economical recession or even famous aircraft accidents more and more people showed trust to aircraft solution for their personal transportation or trading actions.

Figure 1 - Air transportation traffic 1990-2017

The graph represents passengers carried with air-transport carriers, registered for each country, both for domestic and international flights. It is clear that in total for European territory, the traffic showed great rates of increase for the decade of 1990, despite this being a difficult time for the area, with Yugoslavia’s civil war and division into several unions, the official end of the Soviet Union, countries of the central and eastern part facing great economic problems after communistic regime falling apart and of course global interest’s incidents such as Gulf crisis and
There are also included data from the countries with the highest contribution to the total traffic, and which also consist the most important connection destinations for overseas flights.\footnote{Source: International Civil Aviation Organization, Civil Aviation Statistics of the World and ICAO staff estimates. Data from database: World development Indicators}

In the following paragraphs an analysis is included which focuses on the reasons and actions that led to that traffic increase and what were the most important changes they caused to the eco-system, the markets and the habits of European citizens.

### 3.2 Airspace Deregulation

If someone aims to keep a timeline of Low Cost Carriers – from now on referred as LCC – expansion, then has to go back to the ‘80s, when Pacific Southwest firstly introduced that type of operation and management which a little later was implemented by Southwest airline. This airline achieved a tremendous expansion and reached serving 30 states, starting as a common small regional airline service company. The EU in its effort to build a unified, strong and competitive market in many industrial sectors, tried to imitate and finally adopted that model which had already been successful in the US. Deregulations followed, led to market liberalization and put Europe to the second place behind only US market, regarding aviation sector.

Expansion of LCC mainly, was leveraged due to deregulations of airlines introduced by the EU in the late ‘80s and early ‘90s. Flying from one European city to another was, until then, a great issue with high cost, related mostly to cabotage restrictions. First, Second and Third Package or regulations in 1987, 1990 and 1992 set down rules that created free space to new incomers, private owned, to operate and share part of the market. The first package was of a limited time and thus the second one completed it. The third one was in fact the establisher of rules for new companies licensing which led to new standards of capacity and operating for public and private sector. (Butcher, 2010) After the deregulations, the sector was freer to act and react as any other industrial activity to the powers of demand and supply, by negotiating prices and following more elastic cost management policies. The well established American airlines would be a great threat to the national “flag” carriers of Europe, which had a more state-owned model of organization and funding (e.g. Air France, Alitalia, Olympic Airlines). That reason led Europe to adopt a more unified way to conduct bilateral authorization agreements between European destinations. Domestic flights would still be operated as usual while the international ones would face fewer boundaries and that meant lower costs and greater capacity. (Pinkham, 1999)

In pair with the expansion of aviation traffic and LCCs, tourism met another great blooming, as new destinations and more options for air transportation were offered. Increased number of competitors created new high standards of flights’ attendance and tourist traffic.
These increased demand flow generated the need for energy and resources that from now on leave a very different environmental footprint. “The emergence, expansion and evolution of low cost carriers over the last 35 years has been well documented and arguably represents one of the most significant developments in recent commercial aviation history “ (Calder, 2002). It is no question that after such kind of revolutionary decision as those taken after declaration of the three packages of deregulations, a sector emphasizing so much on security and safety rules, now is free to develop networks via unexploited markets that would always exist around his neighborhood. According to ICAO, except the market liberation, two more reasons excuse the LCCs’ development. The first one has to do with the focus on passengers this kind of business models have shown. They have surveyed and decoded passengers’ needs and most importantly their willingness on what they would pay for. Accordingly, they have created products that meet this demand. The third one is that they faced their threats and opportunities with a more corporative attitude. That meant they emphasized on maintaining their competitive advantage and remain strong players in the market war by cutting costs and expand revenues in any possible way to ensure long term prosperity and not only good reputation.

3.3 Indicative statistical data

The traffic of passengers had been continuously increasing since Europe met a more stable political and socio-economic environment that let people operate peacefully and without fear or doubts. In regards to air transportation, both for commercial and freighter flights there were still many defending factors for its development. However, statistics regarding the twenty-years-period of 1993-2013 represent that great expansion of trading and travelling which came as a result of LCC generation.

- 43 European-registered low cost carriers commenced operations in the continent. 17 (40%) were Southwest copycats, 15 were diversified charter operators (35%) and 10 were subsidiaries of full-service carriers (23%). (Lucy Budd*, 2014)
- Of the 43 airlines identified, 33 have now left the market e a failure rate of 77%. While this figure is considerably lower than the 94% failure rate among new entrant post-deregulation start-ups that occurred in the United States (figures only relate to LCCs, not all new start-ups) (Lucy Budd*, 2014)
- By 2013 (Air Berlin, easyJet, Germanwings, Jet2, Norwegian, Ryanair, Transavia, Vueling, Wizz Air and WOW) are still operating (Lucy Budd*, 2014)

During the last 15 years many of those firms have reached in agreements with healthier organizations and merged. This means that in those numbers are included companies that did not actually bankrupted or ceased operations, but also have been part of a greater group of
companies, and helped the specific category of the sector to expand or continue maintaining its size. (relevant ICAO List of LCC)\(^2\)

European Commission’s Annual Report for air-transport industry (Commision, 2016) analyses some very interesting statistics indicating that air-transportation is not very probable to meet any serious downward trend on their profitability or development. Based on researches of the two biggest players of aircraft manufacturers, the air traffic is going to follow the growth of global GDP and grow itself in the long term (annual RPKs over 4% until 2035).

Analysis and research has also revealed that is not necessary for the sector to follow closely or, even more, identically GDP’s trend, and this recognized by the fact of above mentioned historic moments that did not affect passengers preferences or trust to air-transportation and continued increasing the demand and the supply numbers.(Figure 1 - Air transportation traffic 1990-2017) According to the same report, for 2015, airlines had accomplished record time profits by reaching 8.8% increase, while fares decreased by 5% and fuels pricing 44% lower than 2014. Fares and their price actually is the key element during the last decade that enhanced some great companies (Ryanair, easyJet) of the LCC subcategory, to take a share of nearly 50% of the European flights capacity. (Commision, 2016)

### 3.4 Environmental impact of LCC

Aviation is at the top of the most polluting subsectors of transportation taking into account the amount of emissions produced in such short duration trip per passenger. (Vidal, 2007) There have been serious improvements, especially the last 15 year in terms of aircrafts efficiency and fuels improvisation to be as greener as possible, but this does not seem to be enough. In order to have some simple comparisons in mind, the amount of per passengers round trip from New York to California equals to 20% of the annual greenhouse gases produced by his car use. Even if major technological improvement would come in the next few years, trend analysis and forecast show that by 2040 the total number of active aircrafts could reach the record of 50.000, which is almost the double of today’s and with a higher flying frequency. (Schlossberg, 2017)

Tourism of any form and its economic impact in particular, is one of the most crucial components of the global wealth. The multiplying effect of the economy creates millions of jobs by every single coin a passenger or tourist spends on traveling. Aviation and the energy needs of the chosen transportation mean, is probably the most far-reaching element of tourism development and responsible for the environmental impact of the two different kind of human activities, which is gradually increasing. (Santos, 2010) The same consequences follow the freighter flights, obviously, who offer great benefits for the trading sector, markets expansion services provision nowadays, by reaching new high standards of quality, diversification and

\(^2\)https://www.icao.int/sustainability/Documents/LCC-List.pdf
speed to meet or even create new demands. The demanded sources spent on aviation and the seriousness of the sectors emissions affecting climate will be the debate in the next following paragraphs.

There are many elements that contributed to the LCC expansion globally. Some of them have been widely known such as reduction of labor expenses, appliance of extra charge for the so far standard services of airlines such as baggage allowances, meal provision, seat comfort and even shorter ground handling time and cost - currently has dropped to 25 minutes. Additionally, the almost completely web checked in – if someone chooses the airport check in, then is charged differently - capacity of their flights, gives space to companies to reduce their fares and choose different, very offensive and competitive cost policies. This flexible and instantly adaptable model of corporation increased the demand of massive travelling and led to annual records of traffic especially in Europe. According to data of the paper “Impact of Low-Cost Airlines to the European Air Transport Market”, since 1999, when the market liberalization was completed, there has been drawn an average annual growth of 45% for the LCC while in 2005 they carried for the first time more than 100 million passengers. (Vidović, 2006) More specifically, another indicative result shows that after 1985 when Ryanair was introduced to the market, the line of London – Dublin had increased traffic by 500% until 2004 and the last 2 years of the survey, it seems that LCCs had been threatening to take the lead in the market share from the traditional companies.

The contribution of this increased air traffic to the aviation related markets development has been tremendous. Thousands of job positions and positive chances have been created for trading networks and so far underdeveloped areas to meet new high standards of visitor numbers and profitability. If someone would travel to Luton airport before 20 years, the only thing would see is a small grey English suburb around the airport, with almost nothing to show than a small underdeveloped airport. Today, Luton airport is a well known destination to arrange conventions in halls even inside the airport vicinity, as the LCC and companies specializing to that kind of events and hospitality got benefitted by the unexploited market and the low standards airport that Luton hosted, by transforming the whole area surrounding the airport.

### 3.5 Alternative opinions and options

Considering the several forms of environmental impact, one could support that it is much more efficient to fly with LCC rather than normal or high cost airlines. The argument is that LCC have no first class seats , they use space and their load more efficiently and in that way they burn less fuel in a per passenger base. (Starmer-Smith, 2010) Since 1990 the CO2 emissions have doubled up due to LCC expansion, as air transportation has been accessible to the masses.

It is not only the CO2 that is harmful to the environment, as aviation industry also pollutes the atmosphere with several other chemicals by emitting in higher levels of the
atmosphere, which multiplies their negative impact. As any developing sector or business model, LCCs adapt to new trends and find ways to improve their profits and capacity. For example, the first years of operation, they used to serve only short haul routes in order to avoid hangarage costs and return to their airport bases. This case has now changed even for medium haul and transatlantic trips. They have become more offensive players in the market, flying from big airports in order to attract passengers from greater companies and start to differentiate their older approach of reviving small, almost zero trafficked airports with lower fares.

In previous paragraph has been mentioned that aviation sector uses many ways to present data for their own benefit, to avoid operation limitations, fares and taxation. These data draw an appealing picture both for investors and consumers who see a continuous developing industry giving chances to widen borders of human travelling and market exploration. What is not presented or admitted clearly by the sector is the net amount of harmful gasses the industry releases to the environment, no matter how much they try to improve operations and inducted technology.

Mostly affective element for the environmental surcharge, given certain traffic and time period, is the technology used in terms of infrastructure, fleet and fuels. Much less is the load on each aircraft operating, when someone compares similar aircrafts and scales of occupancy. Never to forget that aviation related surveys have proven that the most fuel consuming stages of flight are the ones on the ground, not including the resources needed for ground facilities and services. (Corieri, 2017)

The reader could easily come to the conclusion that traffic frequency and seeking of capacity increase are the two main factors affecting the size and shape of footprint the industry leaves on the environment. The more times an aircraft takes off or operates for any reason, or the more times a passenger chooses an airplane for his transportation the more severe the problem becomes, in terms of pollution and climate warming. Space management, allocation of airports and flight routes are radical elements for the impact of aviation.

The industry, according to CORSIA, has already committed to actualize some big steps by 2020 and 2050, aiming to achieve, as it seems, technological development and airspace management of that kind which are in fact, contradictory to the forecasts concerning sector’s turnover and realistic growth. In the case of LCCs who are considered a fresh, successful and promising player of the market, it becomes more difficult to achieve that carbon neutrality aviation promises.
The above graph includes data of STATFOR describing how LCCs’ market share, in less than a decade, went from 19% to 30% in a global scale, while traditional schedule airlines drew a same percentage decrease from 60% to 50%. The above and below graph show that in Europe specifically, the LCCs’ face greater popularity than traditional airlines over the last few years. A good reason to justify that trend is the natural environment of Europe, which at some points, gives no alternative options for fast and convenient travelling except air transportation. Conditions of that kind give the opportunity to LCCs to compete in a market with so far specific type and number of companies. Exception consist only more traditional countries with well-known flag carriers still hold the higher percentage of passengers with the next one below represents the sharing of air traffic between LCC and traditional schedule airlines in Europeans most trafficked countries.
The five European countries with most low-cost traffic are the United Kingdom, Germany, Spain, Italy and France. However, Spain (excluding the Canary Islands) is the only country where LCCs are more popular than traditional scheduled; in the other countries, the traditional scheduled segment is still in the majority.” (Eurocontrol, 2017)

One of the fastest growing industries, such as aviation, could normally face a lot of restrictions in form of taxes applied - except income related ones- green policy annual targets and fares enforcement. Governments although, still apply very loose measures in terms of controlling their expansion and transportation market competition, as airlines are significant producers of income, taxes, job positions and generally affecting a huge part of the working population of a country. It is obvious that the carbon footprint of this activity leaves no one indifferent as the industry itself does not ensure or seem optimistic that technology applied and bio-fuels will be efficient to help them reach their goals in the following years.

Historic data since 1960 and predictions reveal that air transportation handed the 3% of total passengers traffic is expected to reach 25% by 2020 and 36% by 2050. (Lee et al., 2001). Passengers continuing to grow with their demand airline revenues will be the main reason to doubt the result of the so far applied controlling measures of aviation environmental impact. The possibilities are numerous but the survey has to focus on some basic pillars in order to reduce initially and later control the effect. The first pillar could be passengers’ awareness about the problem and their possible contribution. They have to know how important are their choices and their preference to air transportation in order to mitigate the emissions produced. The second one should do with the states’ decision and initiative to provide both legislation and motives to companies and airports in order to lean to a different approach, not that of growth and development in corporative terms. Green actions should be gradually come closer to profit actualization and probably find ways to correlate these two.
The key definition at this point is sustainability. Development of the sector should always be accompanied by social friendly approach in many aspects. United Nations introduced the 17 Sustainable Development Goals, an Agenda that exceeds the borders of industrial growth limitations, touching aspects of planet’s total action and longtime prosperity. Aviation comes to meet the 14 out of the 17 goals and plays a role in 15 of them, more or less significant from task to task. (Air Transport Action Group, 2017) It is the way the industry operates that helps analyst come to this conclusion. It is also the attitude against public interest issues that sector shows. Speed and quality of service aviation tries to provide enhances the successful meeting of those goals. It would not be dramatic to say that, if it was not for the airplanes these goals would not be easy to achieve, as many human activities are becoming real due to fast transportation.

If EU states are excluded, there many other regions that have opposed to ETS, not only in a matter of corporate philosophy, but in practice, by establishing legislative schemes to ban regional based companies from complying with ETS regulations. Asia-Pacific region has gone through this process while also Russia decided to charge higher fees for EU country based airlines, who pass over the Siberian sky, to Far East destinations. The reasons seem to be more political related than theoretical. (Lee, Jae Woon; Benoît Mayer; Joseph Wheeler;, August, 2016) It is again on the airlines and their customers, to change their habits and co-operate successfully in a way that brings bilateral profits and support the environmental protection, by mitigating irresponsible actions and operation. Marketing policies should focus on matching customers need with more eco-friendly product design and decision making, considering long-term prosperity first. Marketing strategies lead seekers to find more innovative ways than cost controls and commercial agreements to fulfill their targets, by educating their clientele to behave more
responsible as consumers and therefore, to create trends and a corporate image that differentiates their product from the others. Selling right is more important than over-selling, as consumers of today are looking more carefully before realizing a purchase.

The target of the research following, related with the induction of the theoretical part, is to reveal the public opinion and level of awareness in terms of sustainable transportation development, useful products provision and consumer’s behavior against airlines actions and aviation development. It is the researcher’s belief that customers have more unexploited power in their hands than they think they do, making them the key players in the aviation industry sustainable development and market exploitation. There has been a questionnaire spread including questions which examine if the audience under research is “responsible” or not, against public interest issues and sector’s plans for sustainable development. Do this audience seems willing to change habits in terms of consumption and environmental awareness, is one of the basic conclusions of the research.

4. Research analysis – Questionnaire

A common and valid way to extract information about a sample’s trends, preferences and maybe get led to forecasts is to conduct a survey, accompanied by the proper statistical analysis. The tools of questionnaire and population’s specific characteristics correlated with the answers given are meant to be presented in the upcoming chapters. There has been a population of more than 1000 random people which have received invitation to take part in this survey, with a response rate of 15% approximately. Some basic information about the sample is that they are all postgraduate student of universities while the half of this population is under or after MSc courses study, professionals and all of them more or less frequent travelers. Aviation audience and even more specific the LCCs one is of the general public and thus the characteristics of the population selected could not meet very specific characteristics.

Greece is a country with high rates of air travelers and destination for numerous LCCs to operate both annually in a constant base but also for seasonal contractors. In this context the selected population and the sample that occurred fitted with the profile of the fellow students of the institute the writer attends, as well as the social media connections, which draw a group of people of average travelers who have high or typical experience of travelling not only by airplane but also by any other mean of transportation. Moreover to exceed the narrow limits of Greek attendants, the questionnaire was equally accessible to international audience, such as the one of the institute students and Linked In community. Characteristics of a sample of this kind ensure a representative and trustful average opinion which will lead to easier and safer assumptions and conclusions.
The scope of this survey was to highlight initially the weaknesses of the industry’s green plan in combination with the low probability of viable solutions regarding environmental devastation. Conclusion would be either the audience is willing or ready to accept and choose different solutions for their transportation which demand high quality of service in terms of network and speed or not. This puts questions 15 to 18 (Appendix - Questionnaire of the survey) in a higher importance rating considering they indicate the clear opinion of the sample about next best option after air transportation and if they seek or trust a potential plan of ground transportation expansion. The initial planning of the questionnaire proved capable to generate reasonable results and of a high interest.

The first part of the practical analysis contains descriptive statistics and will provide central tendencies of the sample that was tested with questions of likert type, depicting preferences or agreement, disagreement and neutrality against a given example. Other answers will be presented in PIVOT tables combining characteristics of the sample and corresponding answer, to observe the groups that are drawn. There will also be included a chi-square test to check sample’s statistical significance.
4.1 Descriptive statistics

Table 4.1 - Descriptive statistics for Questions 1-19

<table>
<thead>
<tr>
<th></th>
<th>AGE</th>
<th>GENDER</th>
<th>INCOME</th>
<th>FREQUENCY</th>
<th>DESTINATION</th>
<th>PURPOSE</th>
<th>COMPANY'S RESPONSIBILITY</th>
<th>AIRLINE TYPE</th>
<th>CARBON OFFSETS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean</strong></td>
<td>28.26</td>
<td>1.51</td>
<td>1.77</td>
<td>3.42</td>
<td>1.66</td>
<td>1.58</td>
<td>2.18</td>
<td>1.24</td>
<td>2.09</td>
</tr>
<tr>
<td><strong>Mode</strong></td>
<td>26.00</td>
<td>2.00</td>
<td>2.00</td>
<td>4.00</td>
<td>2.00</td>
<td>1.00</td>
<td>2.00</td>
<td>1.00</td>
<td>3.00</td>
</tr>
<tr>
<td><strong>Standarddeviation</strong></td>
<td>5.78</td>
<td>0.50</td>
<td>0.57</td>
<td>0.84</td>
<td>0.50</td>
<td>0.95</td>
<td>0.67</td>
<td>0.43</td>
<td>0.83</td>
</tr>
<tr>
<td><strong>CV</strong></td>
<td>0.20</td>
<td>0.33</td>
<td>0.32</td>
<td>0.25</td>
<td>0.30</td>
<td>0.60</td>
<td>0.31</td>
<td>0.34</td>
<td>0.40</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>C.O. PRICE</th>
<th>C.O. OBLIGATOR CHARGE?</th>
<th>GREEN ACTION PROMOTION MORE?</th>
<th>GREEN CHARGES AIRPORTS?</th>
<th>OTHER TRANSPORTATION</th>
<th>AFFECTIVE FACTOR</th>
<th>INVEST ON ALTERNATIVES</th>
<th>INVEST BY STATES FOR ALTER</th>
<th>CONSIDER YOUR SELF RESPONS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean</strong></td>
<td>2.04</td>
<td>1.49</td>
<td>1.48</td>
<td>1.64</td>
<td>1.39</td>
<td>1.94</td>
<td>1.42</td>
<td>2.21</td>
<td>2.61</td>
</tr>
<tr>
<td><strong>Mode</strong></td>
<td>2.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>2.00</td>
<td>1.00</td>
<td>1.00</td>
<td>2.00</td>
</tr>
<tr>
<td><strong>Standarddeviation</strong></td>
<td>0.65</td>
<td>0.50</td>
<td>0.57</td>
<td>0.84</td>
<td>0.75</td>
<td>0.75</td>
<td>0.65</td>
<td>1.28</td>
<td>0.97</td>
</tr>
<tr>
<td><strong>CV</strong></td>
<td>0.32</td>
<td>0.34</td>
<td>0.38</td>
<td>0.51</td>
<td>0.54</td>
<td>0.39</td>
<td>0.45</td>
<td>0.58</td>
<td>0.37</td>
</tr>
</tbody>
</table>

The approach of statistical analysis and commendation of the questionnaires will follow the route from macro to micro. The above included tables concentrate some useful and common used statistic tools to observe a sample and its trends. Mean - or average and Mode and are values indicating what was the central tendency of the sample for each question, giving initially a profile draw of the trends. In this specific case, answers had a limited price variance, with no decimal prices. Provided answers followed a logical escalation which was later interpreted into numbers from 1 to 5, depending on the available answers choice. The only answer that received different prices was the one declaring age group, receiving the values of 26, 40 and 52 corresponding to age groups of 18-35, 36-50 and over 50. Ages of the sample were concentrated mostly in the first group and fewer in the second one, which is a rather expected as the criterion for the population choice was only to be of a higher education level (at least a Bachelor’s Degree). In addition to that the means of distribution were mostly academic emails and social media public post of the questionnaire, ending to have an average of 28.26 years old sample for the 140 people answering the questionnaire. It is this specific group of people of more than 25
years of age that subject concerns more and the ones that will affect markets trend in the next decades.

The sample was almost equal distributed between men and women, and of an income level of medium or lower class, as the mean was equal to 1.71, closer to 2 indicating Medium and between 2 and 1 indicating Low.

Participants are mostly travelers with a frequency of 2-4 times a year or less (Once per year), referring only to trips by airplane. Their average preference for these trips destination is depicted by the value of 1.66 which means that they mostly travel to European destinations as a first choice and to domestic ones as a second. The drawn average profile is of a leisure traveler who also uses airplanes for business trips, also, but not that frequently. For those trips to European destinations, they would mostly use LCCs instead of Medium or High cost air-carriers, with the average 1.28 confirming that claim. Answers for consideration of company’s environmental responsibility before consuming, awareness about carbon offset and regarding price cost reveal a passenger of low awareness while they claim that the price of carbon offset seems rational, as means vary from 2.04 to 2.18. The sample is divided into two groups in their majority between those who think that carbon offset charge should be obligatory and those who are negative to that prospect, for an average of answers of 1.49. It is the same people that believe the airlines should be promoting more their green actions and also the passengers should behave in parallel more responsible against green aspects, forming a mean of 1.48.

The latter comes in contrast with the next question about airport charges regarding their carbon emissions which also belong to aviation activity. The mean in this case reaches 1.64 a value between the negative answers, the “Not yet” and a definite “No”. Trying to identify why people choose airplanes for their European trips, or what else are they willing to use, they declare a trend to firstly consider convenience, locate price in the second place while train seems to be the only rational choice in their minds. Mean values for those answers are 1.94 and 1.39 respectfully. In the question if there should be better ground transportation development and participants seem to be positive to that possibility of development while also almost half of them share the thought of air transportation incomparability. How states should behave and compensate or not that investment(alternative means of transport) is the description of the next question and their attitude against governmental interference is rather negative or at least there should provision of motives to private investors for ground transportation development, according to a mean of 2.61. The last question refers to the self consideration of environmental responsibility giving answers of absolute negativity or those who are familiar with green actions but both are willing to get improved. Mean goes up to 2.61 for this question.

Since the fact of rational answers’ coding is given, there would be no real meaning in the analysis of the variance, as they receive very specific values and there were no numerical data provided directly by participants. After the mean commendation in the previous paragraphs, there was included mode, standard deviation and coefficient variance statistic to show how close
were the most popular answers to their regarding mean and an effort to reveal the level of
dispersion of the sample. It is not also logical to apply the analysis to all of them as some of
those received values of 1 or 2 corresponding to Yes or No and Male or Female. Comparison of
CV index to 1 value reveals a low variance of the sample for all the answers, as they are lower
than 1 at all cases. It is rather expected taking into account that answers values varied from 1 to 5
but it could also be interpreted into a strong tendency around the average value of answers
providing safer assumptions about the results and the opinions given by the participants.
4.2 PIVOT Tables

Descriptive statistics of responses provided give a general image with certain information about the sample’s trends and attitude against the under discussion subject. They will be followed in the next paragraphs by pivot tables’ presentation, created in MS Excel, providing an easier digested picture of answers and preferences, by combining relatively close questions in pairs. There has been also a test of Chi-square to examine the statistical significance of the sample in four cases for a significance level of 0.05.

In the first case, self considerations of participants’ responsibility about greener attitude before consuming is related to answers about what type of airline would they prefer when they choose for a European destination trip. The two most popular answers are included in the below table which represent the least responsible and the most realistic kind of responsible consumer, who both categories believe they should improve themselves. Responsible consumers choosing a LCC are 25% more than the irresponsible while the medium/high cost travelers come to a distribution of 1 irresponsible to 3 responsible. The vast majority of the sample (75%) would prefer the LCC no matter if they already act responsible or not as consumers.

<table>
<thead>
<tr>
<th>Consider yourself environmentally responsible consumer?</th>
<th>Airline type for European destinations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low cost airlines</td>
</tr>
<tr>
<td>No, I am not at all and I should be more aware.</td>
<td>32</td>
</tr>
<tr>
<td>Yes, I like to be responsible, but I could do better.</td>
<td>49</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>81</strong></td>
</tr>
</tbody>
</table>

- P-value = 0.128>0.05
- $H_0$: Environmental responsibility of consumer does not affect the choice of airlines for short haul flights (European destinations)
- $H_1$: Environmental responsibility of consumer affects the choice of airlines for short haul flights (European destinations)
After applying Chi-square test there has been given the probability value (P=0.128). The sample is not statistical significant which means there are not have enough evidence to reject the Null Hypothesis. This means that in the tales of the distribution model of answers or in limited scenarios the responsibility of a consumer might affect the airline type preference in terms of European district trip conduction.

Table 2.2 - Pie chart for Consumer environmental responsibility/Airline type

Moving to Table 4, the reader finds the choice of each group age per airline type for European destinations. The sample is consisted in its greatest part by ages from 18 to 35 (85%) while only 3 out of 140 respondents belong to ages over 50 years. People over 35 years prefer the LCC while the Medium/High cost airlines are preferred by one of them for every 3 people choosing LCC. The percentage of people over 50 years is not large enough to include a comment for it, but it is the only one that has more answers in the Medium/High cost airline category than in LCCs. Next to the table are presented the P-value and the Hypothesis tested by Chi-Square, which reveals the sample is not statistically significant and, thus, age might not affect in the airline choice in some cases of the respondents, as null Hypothesis cannot be rejected, by the concentrated evidence. What could be concluded in this case is that the most affecting part of the market for the next three decades or more already has chosen the LCCs for that distance of trips, showing that they demand typical service for a good price instead of the pluralistic model of service a Medium/High cost carriers provides.
Table 3 - Age groups/Airline type

<table>
<thead>
<tr>
<th>Age group</th>
<th>Low cost airlines</th>
<th>Medium/High cost airlines</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-35</td>
<td>93</td>
<td>27</td>
<td>120</td>
</tr>
<tr>
<td>36-50</td>
<td>13</td>
<td>4</td>
<td>17</td>
</tr>
<tr>
<td>50+</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Grand Total</td>
<td>107</td>
<td>33</td>
<td>140</td>
</tr>
</tbody>
</table>

- P-value = 0.205>0.05
- \(H_0\)=Age group of travelers/respondents does not affect the choice of airlines for short haul flights (European destinations)
- \(H_1\)=Age group of travelers/respondents affects the choice of airlines for short haul flights (European destinations)

The next table (Table 5) represents the choice of most important criterion when it comes to choose a mean of transport for a journey in Europe and the knowledge of each respondent about what carbon offset is. It seems that for given distance and trip time, the most important criterion is convenience followed by price in percentages of 48% and 30% respectfully. Convenience “voters” do not know or do not exactly know what carbon offset is for a proportion of 2 in 3. The higher ratio of negative answers(73%) is being met for people choosing price as the most affecting criterion, almost equal to the grand total’s ratio of people ignoring what carbon offset is. It also worth mentioning that almost no one seem to care of the environmental impact of their flight, or their per passenger charge, no matter if they know or not about their options. Irresponsibility, ignorance or luck of accessibility to green operations is depicted by these two questions applied to our sample, which is rather disappointing in terms of environmental protection.

Table 4 - Criterion for choosing airline/Awareness about carbon offset

<table>
<thead>
<tr>
<th>Criterion for airline choice</th>
<th>Do you know what carbon offset is?</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>Not that much</td>
</tr>
<tr>
<td>Accountability (schedule, frequency, delays etc.)</td>
<td>13</td>
<td>10</td>
</tr>
<tr>
<td>Convenience</td>
<td>26</td>
<td>17</td>
</tr>
<tr>
<td>Environmental impact</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Price</td>
<td>15</td>
<td>16</td>
</tr>
<tr>
<td>Grand Total</td>
<td>55</td>
<td>43</td>
</tr>
</tbody>
</table>
- P- Value = 0.677 > 0.05
- $H_0 =$ Criterion for transportation (European destinations) choice is not affected by the awareness of passenger about carbon offset.
- $H_1 =$ Criterion for transportation (European destinations) choice is affected by the awareness of passenger about carbon offset.

The Chi-square test at this case, revealed an insignificant statistically sample, for the significance level of 0.05, as the P-Value is equal to 0.677. One more time on this survey, this means that Null Hypothesis could not be rejected. Criterion importance for choosing a mean of transport is possible to be irrational to the travelers that are aware or not about the carbon offset nature.
Survey’s participants were also categorized according to their income level in Low, Medium and High income receivers. One fourteenth of them consisted the High level, 88 belong to the medium class and the rest 42 of them the lower class. One quarter of the sample chooses the accountability as most important criterion for a mean of transport while the 23 of them belong to the medium income class. From the previous paragraph it is known that 67 chose convenience and 42 price. The per class percentages of its criterion convenience is considered to be by far the most important as all income classes reach about the 50% of the answers. It is also noteable that high incomers consider price levels a lot, probably affected by the fact that 60% of them travel from once per week to once per month. One could say that the higher the frequency, the lower gets the demand for excess service or higher price.

According to the Chi-square test applied, the p value turned to be 0.29, which means that for a significance level of 0.05, the sample is statistically insignificant and the Hypothesis of non existence of relationship between transportation choice criterion and income level of passenger, cannot be rejected. This means that in some cases, no matter of the income, the choice of criterion remains the same.

<table>
<thead>
<tr>
<th>Income Level</th>
<th>Accountability (schedule, frequency, delays etc.)</th>
<th>Convenience</th>
<th>Environmental impact</th>
<th>Price</th>
<th>Grand total</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>Medium</td>
<td>23</td>
<td>42</td>
<td>2</td>
<td>21</td>
<td>88</td>
</tr>
<tr>
<td>Low</td>
<td>4</td>
<td>21</td>
<td></td>
<td>17</td>
<td>42</td>
</tr>
<tr>
<td>Grand total</td>
<td>29</td>
<td>67</td>
<td>2</td>
<td>42</td>
<td>140</td>
</tr>
</tbody>
</table>

- $H_0$ = Income level is not related to criterion for transportation choice.
- $H_1$ = Income level is related to criterion for transportation choice.
- P-value = 0.29>0.05
Table 6.1 - Age groups/Alternative means of transport

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Alternative options for transportation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bus</td>
</tr>
<tr>
<td>18-35</td>
<td>7</td>
</tr>
<tr>
<td>36-50</td>
<td>1</td>
</tr>
<tr>
<td>50+</td>
<td>1</td>
</tr>
<tr>
<td>Γενικό άθροισμα</td>
<td>8</td>
</tr>
</tbody>
</table>

Table 6.2 - Bar chart for Age groups/ Alternative means of Transport

A table concentrating the answers about which alternative mean of transport would be chosen for travelling across Europe and group age distribution, followed by a graph depicting the percentages of these categories is ahead this paragraph (Table 5.1, 5.2). Obviously, train comes as a first choice among the given ones, with more than 60% for all groups together and individually. Bus is the least popular answer, as only 7 answers come from ages 18-35 and only one of 36-50. In fact no passenger of the sample and aged more than 50 years, is willing to chose any bus or train.
as alternative option for travelling in Europe. It could be an assumption that people tend to trust the railway network giving numerous option for the traveler in comparison with bus routes, which also provide much more inconvenience. The greater the number of answers the more validity has the claim. Talking about the group age of 18-35, the 95% of them clarifies that they would rather choose train or nothing instead of bus, if airplane is not an option. Young people, with greater experience in travelling and service quality, seem to recognize the advantages of trains and the disadvantages of busses that seem to have limited space for development, not assuming that they are useless for any other kind of trips.

Table 7 - Purpose of travelling/ Alternative means of transport

<table>
<thead>
<tr>
<th>Purpose of travelling</th>
<th>Alternative options for transportation</th>
<th>None of the above</th>
<th>Train</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business</td>
<td>Bus</td>
<td>1</td>
<td>8</td>
<td>27</td>
</tr>
<tr>
<td>Leisure</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grand Total</td>
<td></td>
<td>8</td>
<td>23</td>
<td>109</td>
</tr>
</tbody>
</table>

The different choices of transportation means are now presented in combination with the purpose of travelling of the sample’s individuals (Table 6). It seems that the leisure purpose is highly preferred among those who chose train, as their trip might has time flexibility and seeks for different experiences and pictures. At this point, it has to be mentioned that medical reasons for travelling were not chosen, thankfully, by anyone of the 140 participants. It is also noticeable that almost all the bus potential users belong to the leisure related travelers, which turns all the rest reason categories almost to zero when it comes to match them with the bus as a mean of transport. Only one traveler for business would prefer bus, instead of the rest options, actually. The numbers of this match are again confirming the trend of people to turn to railway system when they choose ground transportation and a safe solution. Other means of transport could mostly be related to drive ways – car users for instance - or seaways, which already provide several solutions but of limited convenience and time saving. The latter category includes 23 participants out of 140.
Table 8.1 - Ground transportation development/Frequency of travelling

<table>
<thead>
<tr>
<th>Should ground transportation be also developed?</th>
<th>Frequency of travelling by airplane</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2-4 times a year</td>
</tr>
<tr>
<td>I am indifferent to that kind of technological development.</td>
<td>6</td>
</tr>
<tr>
<td>No, air-transportation is not comparable to others.</td>
<td>23</td>
</tr>
<tr>
<td>Yes, airplanes should not be the optimal solution.</td>
<td>44</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>73</strong></td>
</tr>
</tbody>
</table>

Table 8.2 - Bar chart Ground transportation development/Frequency of travelling by airplane

Frequency of travelling by airplane and opinion of potential development of ground transportation network are matching at the above shown table and graph. The frequency met the most was the “2-4 times a year” for a percentage of 50% while the second one with almost 30% was the “once per year”. The totally unaware flyers were 5 out of 140. However, they seem rather willing to experience other than airplane means of transport as they believe that air carriers should not be the optimal solution for a short or medium distance journey. Negative answers about the development of alternative ground transportation instead of air transportation draw a total of 35, while the positive ones total a number of 93. Only 12 participants declared indifferent to that kind of development, which they do not use them or do
not care about the mean but mostly about their transfer. Judging by the ratio of negative and positive answers someone could say that a development of ground transportation among Europe, would find easily many supporters, even some of the most frequent airplane users.

Table 9.1 - Carbon offset price/Income level

<table>
<thead>
<tr>
<th>Carbon offset price</th>
<th>Income level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
</tr>
<tr>
<td>High priced</td>
<td>4</td>
</tr>
<tr>
<td>Logical priced</td>
<td>5</td>
</tr>
<tr>
<td>Low priced</td>
<td>1</td>
</tr>
<tr>
<td>Grand Total</td>
<td>10</td>
</tr>
</tbody>
</table>

After setting a price of 25£ for a trip to New York from London for someone to purchase the per passenger surcharge of environment, there was a question of how do the sample consider that price level (Tables 8.1, 8.2). It is divided in three levels of high, logical and low priced and at this case paired with the income level groups of respondents. From the medium level income participants, 19 have claimed they consider the 25£ as a high price and 14 of them as low priced. The vast majority of 55 responses regard those they consider it as a logical price. Twenty two per cent of total responses match the high priced opinion which remains almost the same for all income categories. Probably, if a point is worth mentioning is the amount of responses finding 25£ as a high additional charge for a trip that at least costs 300£. The percentage rises up to 40% in the highly paid category, indicating that it is rather a matter of philosophy rather money spending.
There will be a separate paragraph to summarize the answers provided in the last open question, in which respondents expressed their thoughts about the first step they should do to get improved regarding environmental sensitive issues, their behavior as consumers and to support sustainable development of the market.

It is remarkable that 26 answers were not complete or showed ignorance on environmental issues of market development, with answers mostly relative to “Nothing” as a description if not total blank. There have been also many individuals that got motivated or pushed to the initiative of becoming more aware as a first step as they were totally inactive, probably not their sincere intention but mostly properly informed about basic actions of consumer’s responsibilities and what environmental sustainable development means. In this category of answers, which were the most popular ones, people considered recycling as the only realistic solution or probably what is the most characteristic element connecting environmental sustainable development and consumer’s responsible behavior. Regarding transportation for those who comprehended the survey’s topic, they declared to put effort on reducing private vehicles usage and go for public transportation or search more thoroughly their options and company’s policy before ending to the product they want to buy or consume. Finally, more complete answers referred to multi tasking activities of renewable energy sources, critical thought on CSR of multination companies and generally more time investment on choosing better what is first good for the environment and after that for their personal wealth and satisfaction.

The summary of all answers provided with a moderate responsibility is that most people abandon their efforts and lose motivation to act more aggressively on protecting their long term benefit instead of their instant satisfaction. This attitude finds its cause on lack of information and lack of consumers’ education on green actions and their benefits, while most of them are ignorant or unaware and the rest seem to passively accept corporation initiative in order to be instructed what they should do to get benefitted.

It is not easy to change a habit of a lifetime or to change the philosophy of an adult. Corporations should trust although, the need of their consumers to feel that their choices are responsible and correspond to the value there are paying for. It could be a positive action to instruct them via applications and smart commercial banners about upcoming fares and higher cost of provided services which would be invested on environmental protective actions and not on profits expansion. Web check in tends to disappear any other kind of airport check that was so far known and so people are exclusively connected with their smartphones. All kind of useful information are compacted and transferred via applications and websites, indicating that personal contact via smartphones is the gate to establish any kind of new cost policy and service to your clientele. Social media also could find their cause in this action to gather connections and inform your social community to choose specific products in order to get awarded by price benefits in a form of a game or competition. In this way people meet an easy way to change their habits and find modern ways and motives to get both benefitted for their pocket and for their environment.
Corporations on the other side will meet their goals both on environmental concerns and on CSR issues.

Smartphones and web are not accessible by all kind of people. Consumers of a lower age of 15 or higher of 70 are not or should not be familiar with personal accounts activity for obvious reasons. In the second case of the third age audience someone could assume that is not also reasonable to invest in such a weak part of the consumers as they do not travel so much and will probably find it difficult to adapt on such modern trends. On the other hand kids and teenage audience is a much more interesting group target that could be educate to spent wealth and time responsibly before even start to act as adults. Education via school programs or via public activities and fairs could meet goals of marketing policies and commercial actions that benefit companies’ image and lead people to find easier their way on companies that care for the public good. This audience that receives such kind of services is easier to develop strong relationship based on trust both with the industry but also with the airlines.

Discussion on alternative options, which is and the main message of this survey, is a matter to concern bodies of higher responsibility and power such as Ministry of Transportation and Education. Considering as a fact that a reliable network of other forms of transportation exists or could adequately supported, people could be motivated to use those networks instead of easy but not beneficial in a holistic way solutions. Younger audience should again taught to search thoroughly their options and think before acting in order to consist individuals that will consume with first priority the long term prosperity and not their instant satisfaction. To be given as an example, it is the same attitude to avoid your personal vehicle usage and the provided comfortability by using public transportation on a busy day inside the city center or for moderate distances transportation.

It is a matter to concern all parts as environmental balance and general good need all available powers to succeed and reach the tempted targets.
5. Conclusion

Transportation and connectivity is for our society what blood is for our bodies. The importance of it is of no doubt and discussion, so it could not fit in a ten thousand words thesis even to analyze a single form of it which is aviation. The effort though of this work was focused on a specific trend of the last 25 years which has brought tremendous changes both in transportation and aviation, but also to the terms of pricing, trade and tourism development. The under analysis time period is marked by the introduction and expansion of LCC which multiplied traffic rates and capacity records, as the so far mean of transport accessible only elite society or by wealthy enough people who could afford the inelastic price’s level, was now a thing for the average consumer.

Changes of the market balance of that kind are never single directed, which means their multilevel effects generated questions and challenges to society’s, scientists’ and corporation’s mind. Society representing consumers part, had to deal with new offered products and opportunities but also with side effects to several other parts of everyday life that needed reasonable control. Corporations and scientist on the other hand, had to work both for the market’s and for the environments benefit, to maintain sustainable development and at the same time maximum effectiveness of sources usage. The biggest question of this co existence of expanding corporation and technological progress is whether it is better to continue supporting LCCs operation or not depending on their impact on the environment.

The first few paragraphs of the dissertation referred to the so far progress in legislation by governments and global size bodies trying to support equally environment and corporative activity. Impact of aviation is not only related to aircrafts carbon emissions but also to many other forms of environmental surcharge such as noise pollution an ground deformation or urban life destruction. The common point of all these subject is that they could be mitigated by space management and technological progress – mechanical and chemical related - as far as the traffic is of a standard level or growing. The legislation part has accomplish to draw specific lines and supportive alternatives for states and private bodies to follow in order to remain environmental friendly and continue their beneficial to the society’s activity operation.

Implemented tools that are currently used or in the first place to be used are mostly carbon offsetting or otherwise alternative means of transport. Examination of the specific area of European district made it a bit easier to reveal statistics that make clear statistics that make clear traffic growth and its environmental impact it is not something to ignore, given that it will expand highly in the next few decades. Does the sector expand steadily or is it reasonable to continue this expansion, was the central line of the subject and was also the questionnaire’s targeted question seeking for survey induction.
Questionnaires have been built up to gather demographical data and examine population’s relativity to general aspects of environmental devastation and intrigue them for their responsibilities against their environment and reasonable consumption, revealed some very interesting information. The most important come outs of the survey were the unawareness of what environmental responsibility meaning by the majority of the public, but also the spontaneous willing to follow better habits as consumers and declare readiness to use public means of transport and products that might benefit their environment and lives more than their wealth and convenience. People that took part in this survey were of a higher education level, ages varying mostly from 25 to 50 and could be characterized as moderate travelers of short or medium distances with a typical frequency of flying four or less times a year. In a few words a very representative sample off the greatest part of consuming population.

To summarize their opinions and relate them with the sector’s progress and future plans, consumers themselves need much better and in depth education and training in order to behave responsible and consume reasonable. States in cooperation with private parts should look not only to achieve technological progress bringing solution but also to mitigate the expansions of aviation traffic and invest in other forms of transportation for their profit and pollution preventive actions. Expertise and power of supply in a time of great demand is essential to help and create a mainstream that aims to the long term prosperity of the air transportation and also a healthy development of all closely connected to tourism sectors. Global economy could not be irrational to transportation as it is clearly declared above and always synchronized with environmental protection high standards.
Appendix - Questionnaire of the survey

Environmental impact of Aviation
“What people know and how would they act if they knew their choices?”

1. Email address:

2. Age group
   18-35
   36-50
   50+

3. Gender
   Female
   Male

4. What is your income level?
   Low
   Medium
   High

5. Frequency of travelling by airplane
   Once a week
   Once a month
   Once a year
   2-4 times a year
   Never

6. Destination of your trips (mostly):
   Domestic
   European
   Transatlantic

7. Reason of travelling(most usual)
   Leisure
   Business
   Medical reasons
   Other

8. Before consuming/buying a service/product do you consider the company's environmental/social responsibility or not?
   Yes, I do
   No, I do not.
   I like to know if they behave or operating fairly/generously, before spending money or trusting a company.

9. For your trips between European destinations would you prefer:
   Low cost airlines
   Medium/High cost airlines

10. Do you know what the carbon offset is?
    Yes
    Not that much
    No

11. Carbon offset is a way to pay for your trip's environmental impact charged per passenger. If 25$ is the carbon offset for a passenger flying from London to New York, do you consider it as:
    Low priced
    Logical priced
    High priced

12. Carbon offset programs - purchases are now a voluntary action. Do you think airlines should put this as an obligatory charge at your fares?
13. Do you think airlines should promote more their green actions and their passengers options for that case?
Yes, they definitely should
It is both sides’ responsibility to act greener.
No, it's up to the passenger.

14. Aviation emissions also regard ground handling services. Do you think airports should also include these charges to their green action programs?
Yes
No
Not yet

15. In case of alternative options of mass transportation around Europe, would you prefer:
Train
Bus
None of the above

16. What is the most affecting criterion to choose a mean of transport instead of another? (Consider it for a trip from Thessaloniki to Berlin)
Price
Convenience
Accountability (schedule, frequency, delays etc.)
Environmental impact

17. Should transportation companies invest on improvement of ground transportation network?
Yes, airplanes should not be the optimal solution.
No, air-transportation is not comparable to others.
I am indifferent to that kind of technological development.

18. Do you think states should contribute to the development of greener and better transportation network among European destinations?
Yes, it should be of their first priorities.
No, public owned transportation is not trustful enough for that level of operation.
Maybe initially there should be motives given to investors of that interest by governments.
Yes, it is not possible to develop such network without governmental support and interference.

19. Do you consider yourself as a responsible traveler/consumer in terms of green action and reasonable consumption?
Yes, I always take into account environmental impact and the necessity of the trip, before deciding.
Yes, I like to be responsible, but I could do better.
No, I am not at all and I should be more aware.
No, I am not but I do not know what I need to do.
No, I do not think my contribution is that important.

20. What do you personally do to improve yourself as a consumer and support environmental sustainable development of the market?
Bibliography


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