



## City Research Online

### City, University of London Institutional Repository

---

**Citation:** Addepalli, S., Pagalday, G., Salonitis, K. & Roy, R. (2018). Socio-economic and demographic factors that contribute to the growth of the civil aviation industry. *Procedia Manufacturing*, 19, pp. 2-9. doi: 10.1016/j.promfg.2018.01.002

This is the published version of the paper.

This version of the publication may differ from the final published version.

---

**Permanent repository link:** <https://openaccess.city.ac.uk/id/eprint/22145/>

**Link to published version:** <https://doi.org/10.1016/j.promfg.2018.01.002>

**Copyright:** City Research Online aims to make research outputs of City, University of London available to a wider audience. Copyright and Moral Rights remain with the author(s) and/or copyright holders. URLs from City Research Online may be freely distributed and linked to.

**Reuse:** Copies of full items can be used for personal research or study, educational, or not-for-profit purposes without prior permission or charge. Provided that the authors, title and full bibliographic details are credited, a hyperlink and/or URL is given for the original metadata page and the content is not changed in any way.

---

---

---

City Research Online:

<http://openaccess.city.ac.uk/>

[publications@city.ac.uk](mailto:publications@city.ac.uk)

---



6th International Conference on Through-life Engineering Services, TESConf 2017, 7-8 November 2017, Bremen, Germany

## Socio-economic and demographic factors that contribute to the growth of the civil aviation industry

Sri Addepalli<sup>\*a</sup>, Gerardo Pagalday<sup>b</sup>, Konstantinos Salonitis<sup>a</sup>, Rajkumar Roy<sup>a</sup>

<sup>a</sup>Manufacturing, SATM, Cranfield University, Cranfield MK43 0AL, UK

<sup>b</sup>IKERLAN, P<sup>o</sup> J. M. Arizmendiarieta, 2, Arrasate-Mondragón (Gipuzkoa) 20500, Spain

---

### Abstract

The civil aviation industry has captured the world's share both in terms of operations and markets. The International Civil Aviation Organisation (ICAO) reported an increase of 6.3 percent in passenger traffic to 3.7 billion in 2016 based on recorded departures globally. This paper is an effort to understand the driving force for the civil aviation sector based on demand. As per published reports, the trends show the continued growth in the sector even with the inclusion of production challenges in order to meet global market demand. Though the sector is heavily reliant on a variety of challenges and factors, the industry has established itself as the most advanced and lucrative industry that continues to 'PULL' the associated industries. This paper identifies and establishes the 'push' and 'pull' factors under social, demographic and economic factors and how they exercise significant control making the ever-growing industry RESILIENT to changing geo-economic and political landscapes.

© 2018 The Authors. Published by Elsevier B.V.

Peer-review under responsibility of the scientific committee of the 6th International Conference on Through-life Engineering Services.

*Keywords:* Manufacturing network, Economics, Logistics

---

---

\* Corresponding author. Tel.: + 44 1234 758346

E-mail address: [p.n.addepalli@cranfield.ac.uk](mailto:p.n.addepalli@cranfield.ac.uk)

## 1. Introduction

Over the last few decades, civil aviation sector demand has continued to grow. A recent ICAO release in January 2017 reported that there were 35 million departures globally in 2016 with global traffic expressed as revenue passenger-kilometres or RPKs accounting to 7,015 billion [1]. The Air Transport Bureau reported +7.6 percent year-on-year growth between 2015–16 (Fig. 1) confirming the continued growth and impressive expansion of the sector in terms of RPK [2].

Further, the 2016 forecast of the global gross domestic product (GDP) growth has been reported to be around 2.4 percent. It is worth mentioning that more than half of the global tourist traffic and about 35 percent of the world trade by value is covered by air travel. On the contrary, the global cargo traffic market follows an alternate profile and is characterised by the industry's strong dependence on current production and handling capacities. Despite the cargo traffic being less prominent than the passenger traffic, it continues to show a growth of 3.8 percent in terms of freight tonne kilometres (FTKs) towards to end of 2016 [3]. Though the cargo sector showed a good year-end performance, there were significant challenges accounted due to stagnation of world trade.

With the ever increasing demand of aircrafts and freight liners especially in the civil market, the manufacturing sector is pursuing the development of innovative next generation platforms to achieve cost effectiveness, travel comfort and delivery targets. The Airbus's Global Market Forecast for 2016-2035 reports that the growth in air traffic would account to a rise of 4.5 percent annually with a demand of 33,000 new aircrafts approaching the value of US\$5.2 trillion over the next 20 years [4]. Further the AGP reports that, in the UK alone, there is a backlog of over 13,000 aircrafts with an equivalent value of GBP£200 billion suggesting a large scope for growth in the civil aviation sector [5]. The current landscape clearly indicates that the airlines continue to achieve profits not only due to good traffic behaviour but also due to an increase in efficiency in aspects such as airplane load, accurate business models and other internal activities. This economic bonanza leads airlines to renovate their fleets, which has repercussions on the backlog for aircraft OEMs. The aim of this paper is to understand various factors that govern the growth of the sector through the identification of major 'push' and 'pull' factors that control the manufacturing demand.



Fig. 1 Passenger traffic in RPK (2015-2016) [2]

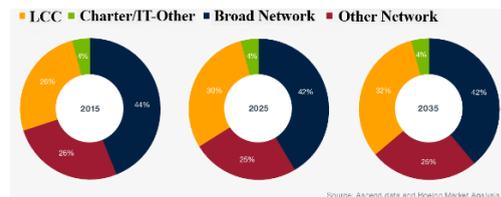


Fig. 2 Forecast business models as per Boeing [15]

## 2. 'Push' and 'Pull' – an introduction

In order to understand and establish various factors that contribute to the growth of the sector, it is essential to define them as 'Push' and 'Pull' factors. Push factors may be referred to those internal factors that push the industry to adapt and consume products. These factors are intrinsic and are dependent on intangible socio-economic, demographic and market knowledge. 'Pull' factors on the other hand are external forces that attract the industry to influence the consumption of the same product [6]. These 'pull' factors are heavily reliant on consumer's needs and behaviours' including attractiveness, convenience and accessibility through innovative technological features, price, quality and a range of dependent metrics. For this research, the following fundamental key performance indicators or KPIs are used;

- Social
- Economic
- Demographic

Most of the factors have both a 'pushing' and a 'pulling' attitude and some which constitute as basic influencing factors. For the purpose of the paper, only socio-economic and demographic factors are considered. They are classified mostly based on how much they sway on the push and pull attribute.

### 3. Key factors influencing demand

Persistence and resilience are two themes that best describe air transport demand over the last few years. The large increase in passenger traffic of 6.4% (2015) represents the strongest growth rate since 2010 (6.6%), the year in which it rebounded from the Great Recession. In fact, despite a slight weakening of economic growth at 3.1% in 2015, growth in passenger traffic approached the pre-recessionary growth levels that were seen in 2004 to 2007 [7][8]. International tourism in particular was irrepensible in 2015, even considering the geopolitical risks that persisted in certain parts of the world, such as Eastern Europe and the Middle East. By and large, the international traveller appears to have discounted these risks. Thus in order to assess the various factors, three KPIs have been used, the details of which are addressed in the sub-sections below.

#### 3.1. Social factors

The social dimension points into the direction that, demand patterns for aircrafts are different between the world regions. But, in fact, the demand patterns are strongly affected by economic and demographic factors and it is difficult to identify social factors that play a relevant role. Considering Boeing [7] and Airbus market analysis [4][9] and the factors that those companies take into account for making their future demand scenarios, social factors do not appear between the drivers that they consider. A number of economic, performance and productivity related variables are considered in their methodology and only “Propensity to travel” (Pull) and “Environmental awareness” (Push) could be considered in the social field. Moreover, both are not independent from economic trends and they would not be considered as first class factors. Where social dimensions traditionally included economic awareness, technological affinity, cultural particularities, traditions, conventions, habits, behaviour (e.g. saving behaviour), values and needs of a country’s population, none of these aforesaid dimensions appear in the market analysis by major corporations and only “second class” factors have been considered.

##### 3.1.1. Propensity to travel

The passion to travel dominates the industry with a strong relationship between the GDP and willingness of passengers. As per Airbus GMF, European and American nationals are the most willing passengers, and it is estimated that the current level is at 25 percent as of 2015. Further the report forecasts that in 2035 the total population who will travel by air will increase to 75 percent of the population of emerging countries [4]. This is clearly evidenced by the world airport traffic rankings issued by Airports Council International (ACI), where Atlanta, Beijing and Dubai took the top 3 places (Table 1). ACI reported that of the 1,179 airports across the world, the passenger’s hub grew 4.7 percent with approximately 1.4 billion people passing through the top 20 airports representing 18 percent of the global passenger traffic [10]. These confirm the behavioural attributes of the passengers and establish that there are a variety of factors that will support the growth of the sector establishing this social factor as a ‘pull’ influence to the industry.

##### 3.1.2. Environmental awareness

Reduction of noise and fuel consumption in terms of reduction in CO<sub>2</sub> emissions will continue to be the primary target and will be achieved through the development of commercial aviation technologies. Development of engine technologies will be advanced through the use of innovative materials, cutting-edge aerodynamic designs and smart manufacturing techniques, which will be driven through heavy investments in research and innovation amongst other scientific groups. Specific technologies such as advanced wing designs that contribute to better fuel efficiency (e.g. using composites) form typical examples where weight reduction would significantly reduce fuel consumption thereby contributing to further reduction in emissions [7].

Much of this progress improves airplane operation economics, which directly affect the airline profitability. This further enables the industry’s move to a more sustainable scenario, where environmental impacts suffer an important improvement. Boeing reported that there has been significant reduction of both noise footprint by 90 percent and emissions by 70 percent from the jet engines produced in the late 2000s when compared with those from the 1960s [4][7]. Thus, through global regulations established to control reduction of emission and noise footprints have ‘pushed’ the industry to continuously monitor and improve the technology and provide fuel efficient and environmental friendly jet engines. Further roadmaps such as Flightpath 2050 envisage the need to cut down the noise and emission levels by 65 and 70 percent respectively [11].

Table 1 2016 World airport traffic rankings (Top 5) [10]

Airport Name	Country	Rank
Hartsfield-Jackson Atlanta International Airport	USA	1
Beijing Capital International Airport	China	2
Dubai International Airport	UAE	3
Los Angeles International Airport	USA	4
Tokyo International (Haneda) Airport	Japan	5

Table 2 2016 Economic performance of aviation sector (global) [12]

Worldwide airline industry	2014	2015	2016
Spend on air transport, \$billion	785	750	740
% change over	4.1%	-4.4%	-1.3%
RPKs, billions	6216	6679	7093
% change over	5.7%	7.4%	6.2%
Return on invested capital (ROIC) %	5.9%	9.3%	9.8%
Aircraft fleet	25,860	26,788	27,930
% change over	2.9%	3.6%	3.9%
Passenger load factor, %	79.9%	80.4%	80.0%
Fuel spend, \$billions	226	181	127
% change over	-1.8%	-19.9%	-29.6%

### 3.1.3. Summary

Published reports and literature suggest that the propensity to travel will continue to grow over the next 20 years establishing it as a major ‘pull’ factor. However, environmental awareness will heavy control the manufacturing practices with pressure on the industry to achieve targets ‘pushing’ the sector away.

### 3.2. Economic factors

In any industry, economy plays a pivotal role that encompasses the overall growth of the sector, and civil aviation, with the ever-growing demand is no exception. To give a big picture, Airbus GMF 2016 estimates the 20 year demand for new passenger and freight aircrafts to be just over 33,000 aircrafts constituting a market value of over USD\$5.2trillion emphasising and establishing the impact of market growth [4]. The report suggested that the yearly RPK growth from emerging and developing markets accounted to +5.6 percent and that from the developed markets at a +3.7 percent as of 2015. This situation is mainly influenced by economic factors, which vary significantly between regions. Some of the factors have an unpredictable future, depending on regional and local behaviours and decisions. Others will vary depending on the strategic decision adopted by the companies. In order to fully assess the economic factors, they are grouped under four categories as explained in the sub-sections below.

#### 3.2.1. Key economic indicators

In aviation, economic development is a strong indication for market demand. The evolution of Emerging and Developing regions establishes a growing scenario that existing manufacturers are trying to address. Being GDP a common indicator, others are arising as crucial for understanding the actual market demand. Whilst GDP remains as an important driver for air transport, its relationship to aviation’s growth has evolved over time. This is apparent at a global level, but is driven by activity at a regional or country level. Airbus reported that wherein the world GDP was under 2.6 percent during the second quarter of 2016, the passenger traffic showed an overall growth of +6.2 percent with a spilt of 4.2 to 2 percent between 54 emerging markets and 32 advanced markets [4]. It is clear that GDP is not the only factor that drives air traffic growth. Components such as private consumption, international trade, tourism, crude oil prices, airline profits and increase in productivity all contribute to the economic factors [12].

#### 3.2.2. Liberalisation

International air transport is governed by a 60 year-old set of rules, the bilateral system. It was designed for another age to enhance free peaceful movement of passengers and freight. Bilateral Air Service Agreements contain restrictions on the number of airlines and frequency of services on many international routes, where many countries have limits on airline ownership and control by foreign nationals. Airlines have built an industry that is safer, more accessible and more efficient than ever before. Now we need governments to bring policies in line with the changes

airlines have achieved. The future success of the industry rests on greater commercial freedom to serve markets where they exist and to merge and consolidate where it makes business sense [13].

This liberalization can be reached using different ways: either through bilateral agreements and or agreements across trading blocks e.g. ASEAN. Liberalisation of international air transport is essential. The liberalisation of operational and ownership restrictions is not an easy process, but it can be a very beneficial one. Experience from other industries demonstrates the positive impact it can have for both consumers and producers. A modern, commercial and global airline industry requires modern, commercial and global rules.

### 3.2.3. Airline business model

Low-cost carriers (LCCs) have revolutionised the short-haul market, expanding the choice of air transport to consumers at the lowest cost. And they have done so by leveraging their cost efficiency and innovation to remain in a leading position, even in a disconcerting market. However, as the industry dynamics have changed, so have the business strategies of LCCs.

To compete for cost-conscious, short-haul passengers, many traditional full-service carriers created new products, restructured and streamlined their processes, slashed costs and aggressively priced many routes. As a result, LCCs were forced to change or enhance their business models [14].

Airline business models continue to evolve. What was once a clear division between network, low-cost and charter models is now less clear, with network carriers operating low-cost, short-haul subsidiaries lost-cost carriers providing frequencies and services that attract business passengers; and charter carriers venturing into single-seat sales. Low-cost carriers are even starting long-haul service, competing with network carriers on point-to-point routes. Boeing reported that the LCC models estimated at 26 percent of the global share will continue to increase to about 30 and 32 percent in 2025 and 2035 respectively. This will reduce the overall broader network share of 44 percent in 2015 to just over 42% in 2035 [15].

### 3.2.4. External shocks

Although the air-transport industry is subject to occasional market shocks, the industry's demand is resilient and services are often seen as essential, and spending on discretionary trips for vacations or family events is frequently high priority. Over the last 30 years, the aviation industry has experienced recessions, oil-price shocks, near pandemics, wars, and security threats, yet traffic has continued to grow on average at 5 percent annually. Changes in the structure of an economy can also result in short-term effects. For example, although the slow-down in China's GDP growth attracted much notice in the media, air travel continued to perform well. The reason: Chinese consumer sectors, which drive travel behaviour, remained strong, while heavy industrial production and fixed investments weighed on top-line growth, feeding the headlines [4].

### 3.2.5. Summary

In summary, the analysis has shown that characterising economic factors is a challenge in itself. Though key economic indicators contribute to the 'pull' factor, but liberalisation and the airline business model act as those internal 'push' factors forcing the industry to adapt to the ever-changing geo-economic variations. Over the years, there have been significant changes, in terms of technological and business models with significant push from factors such as external shocks due to multiple events which have served as both 'push' and 'pull' factors.

## 3.3. Demographic factors

Demography is an important factor dependent on the growing population and their behavioural attitude to travel by air. Emerging and developing countries continue to not just suffer important changes but also make a huge impact on this factor. This will influence the need for aircrafts, with very different positions for the regions. Both, quantity and "quality" of this population must be taken into account for analysing the aircraft future demand. The major focus areas that affect the demand may be put into three categories as seen below.

### 3.3.1. Urbanisation

Long-haul traffic will increasingly be to, from or between aviation mega-cities, (defined as cities with more than 10,000 daily international long-haul passengers) rising from 90 percent (1 million passengers a day) today to 95 percent (2.5 million passengers a day) by 2035. Aviation mega-cities are centres of urbanisation and wealth creation

and will increase from 55 to 93 cities by 2035 with 35 percent of World GDP centred there. These mega cities are already served well by air transportation and the existing route network will accommodate 70 percent of all traffic growth between now and 2035. Having a majority of the premium passengers along the megacity routes, reports indicate that the traffic due to premium passengers in 2016 accounted to 11 percent which can be directly related to the growth in direct trade relations between international markets [4].

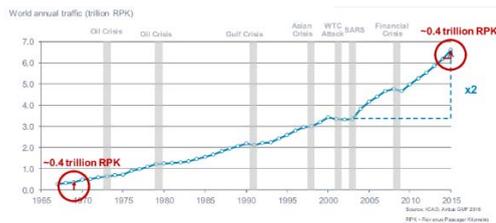


Fig. 3 Annual traffic in terms of RPK (Global) (1965-2015) [4]

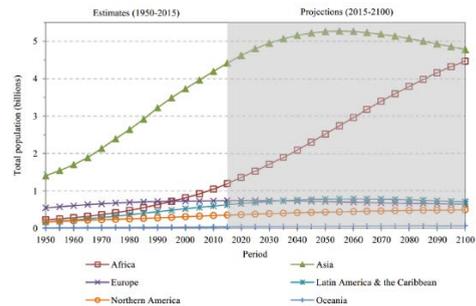


Fig. 4 World populations estimates (1950-2015) and projections (2015-2100). Source: United Nations World Population Prospects (2017) [16]

### 3.3.2. Working age population

The working age population varies between established and emerging markets which also affects the projected evolution. If the working age population increases, it will imply that the number of passengers who travel will also increase, suggesting the need for additional aircrafts. It should also be noted that over the next 15 years, aircrafts under operation now will also be aged and retire indicating the need for replacing air crafts indicating a large growth over the next few decades. Earlier this year, the United Nation's Department of Economic Affairs reported that the world population continues to grow with the working age population (between 15-59 years) constitute to just over 61 percent of the world population which currently stands at 7.6 billion (mid-2017) [16].

Fig. 4 presents the regional population estimates and suggests that the largest contributors will be Africa and Asia. This clearly indicates that the world population is set to grow due to improved fertility rates and significant life expectancy rates, suggesting that there will be boost in the survival rates with the life expectancy project to 77 years as of 2045-2050 a significant rise from the current rate of 71 years (2010-2015) [16]. With this growth comes the challenge of coping with the demand the industry is set to face. With a record high number of backlogs in the current scenario, the industry will need to push harder to make ends meet.

### 3.3.3. Growing middle classes

The previous sub-section though described the rise in working age population as a factor; economy does play a significant role in estimating the demand for aircrafts. Logically speaking, the larger the growth in economy, the larger the share of working age population strongly establishing that the passenger traffic will increase [17]. It has been reported that the middle classes currently estimated at 38 percent of world population, is set to rise to 55 percent of an estimated 8.8 billion people as of 2035. The bulk of this growth comes directly from new and emerging markets, suggesting a two-fold increase over the next 20 years [4].

### 3.3.4. Summary

This sub-section mainly looked at three demographic indicators. Of the three factors; the study has suggested that urbanisation and growing middle class population, serves as industry 'pull' factors, whereas the working age population poses as a challenge and acts as a 'push' factor. In any case these factors suggest a strong demand and significant growth the aviation industry needs to achieve to cater to their demands.

## 4. Discussion

The review of the various 'push' and 'pull' factors affecting the demand in terms of aviation industry has shown that the industry continues to grow despite a variety of extrinsic and intrinsic variations and has established itself as that independent transport mode that represents a growing global community. This sector, over the last few decades

continued to grow despite huge political and economic renaissance, resistant to all those changes, in other words predominantly 'RESILIENT'.

The research undertaken covered three broad areas: social, economic and demographic, as indicated in the introductory chapters. The study included data collection and interpretation from civil passenger and freight aircraft sectors. The 6.3 percent rise in income accounting to 7,015 billion RPK shows the continuous growth and exciting future expansion of the aviation industry owing to overall traffic growth in the sector [1]. The analysis of the data revealed that the propensity of travel, urbanisation, growing and expanding middle class population together with the creation of megacities of the future all constitute to form a pull factor. Whilst environmental awareness, working age population and some external shocks push the industry sector, the assessment also highlighted that the airline business model has a negative outlook that contributes to the overall push factors. These factors and trends on the whole signal towards a positive and growing sector, and will continue to expand for the years to come. The analysis presented is primarily based on the analysis of data obtain from the public domain and are originally produced and presented by international regulatory authorities and specific industrial organisations. For this analysis, a huge variety of statistics were considered, ranging from global demand to crude oil process and also include information ranging from economic growth to infrastructure expansion in an effort to provide a comprehensive picture to identify current push and pull factors that influence the aviation sector.

The review of current civil aviation regulations reveal that they are heavily driven by two major factors, the penchant of people to travel, be it business or for leisure and the other being environmental regulations in place. The aviation traffic strongly supports the claim that the propensity of travel pulls the entire industry influencing and increasing the industrial demand. Policies such as the Chicago Convention 1944 and Civil Aviation Acts 2012 bear a testimony to the increase in air traffic. Continuous growth has also allowed progress in economy due to urbanisation, growing middle age and working age population and the likes. All of these, not just directly boost the economy of the industry, but also support markets and individual nations that provide a platform for trade and facilitates growth. With growth also comes a host of other issues such as safety, and security are controlled by policies such as the Montréal 2014, Beijing 2010 and Aviation (Offences) Act 2003 to allow peaceful travel to take place between international borders and thus provide a safe and secure mode of transportation.

In order to maintain the demand, it is necessary for any industry to improve their manufacturing performance and business strategies through continuous research and innovation. Policies such as Flightpath 2050 [11] and European Aviation Strategy report [18] the need and level of innovation and research that helps meet the ever-growing demand of air travel. The other factor that helps and assists growth of the civil aviation industry are the policies and roadmaps of competition that provide a healthy platform for the industry to provide, deliver and maintain high standards at all times. The policies such as the Aviation Strategy Report [18] and European Competitiveness Report (2011) [19] provide a roadmap on the current level of competencies achieved by various industries that support the aviation sector and ways to remain attractive at a global scale.

Table 3 'Push' and 'Pull' factors that affect and influence demand

Push	Pull
Environmental Awareness	Propensity to travel
Working age population	Urbanisation
External shocks	Growing middle classes
	Key economic indicators
	Liberalisation
	Airline's business model

Environment and its awareness is one factor that pushes the industry even in times of increased demand. With the overarching policies such as the Environmental Protection Directives (EC D 2016/4; 2016/5) and policy framework on energy (COM/2014/015), there is huge push on the sector to cut pollutions levels with clear pressure to reduce it to 24% and 32% for 2020 and 2030 when compared with the 1990 levels.

Overall, the impact of the policies on the aviation sector have and will continue to contribute to the growth in air traffic and the industry will continue to remain resilient to changing geo-economical and geo-political landscape. The

industry will also be supported by the regulatory authorities who will continue to support the industry through effective regulations catering to the growing demands of the industry. The various factors have now been tabulated below Table 3.

## 5. Conclusion

The ability to capture the future demand for aircrafts has always been a challenging aspect for the travel industry. With the ever growing industry and the current disruptions that do not allow the industry to deliver the required number of aircrafts hugely affect the productivity of the industry as a whole. Industries are working with governments and academic research organisation to help meet both current and future challenges. This paper is an effort to address those top factors that mainly shape the demand for the sector. Moreover, identifying opportunities and threats is in itself a major contribution. This research mainly includes social-economic and demographic influences on the market. It is the notion that, identification and establishment of these factors could help boost manufacturing productivity so that the demand is maintained at all times, both current and future especially for an industry that is hugely ‘pulling’ and ‘resilient’.

## Acknowledgements

This research was funded by the European Union’s Horizon 2020 research and innovation programme under the grant agreement No. 724112 (SCORE).

## References

- [1] ICAO, “Traffic growth and airline profitability were highlights of air transport in 2016,” 2017.
- [2] ICAO, “JAN 2017 : Air Transport Monthly Monitor,” 2017.
- [3] IATA, “Air Cargo Ends 2016 on a Positive Note,” 2017. [Online]. Available: <http://www.iata.org/pressroom/pr/Pages/2017-02-01-01.aspx>. [Accessed: 03-Aug-2017].
- [4] Airbus, “Global Market Forecast - Mapping Demand 2016-2035,” 2016.
- [5] Aerospace Growth Partnership, “Means of Ascent: The Aerospace Growth Partnership’s Industrial Strategy for UK Aerospace 2016,” p. 44, 2016.
- [6] S. Baloglu and M. Uysal, “Market segments of push and pull motivations: A canonical correlation approach,” *Int. J. Contemp. Hosp. Manag.*, vol. 8, no. 3, pp. 32–38, 1996.
- [7] Boeing, “Current Market Outlook 2014-2033,” 2015.
- [8] Boston Consulting Group, “Understanding the Demand for Air Travel : How to Compete More Effectively,” 2006.
- [9] Airbus GMF, “Global Market Forecast 2015,” 2015.
- [10] Airports Council International, “ACI Media Release,” 2017. [Online]. Available: <http://www.aci.aero/News/Releases/Most-Recent/2017/04/19/ACI-releases-preliminary-2016-world-airport-traffic-rankingsRobust-gains-in-passenger-traffic-at-hub-airports-serving-transPacific-and-East-Asian-routes>. [Accessed: 06-Aug-2017].
- [11] M. Darecki et al., “Flightpath 2050,” *Flightpath 2050 Eur. Vis. Aviat.*, p. 28, 2011.
- [12] International Air Transport Association (IATA), “Economic Performance of the Airline Industry,” pp. 1–6, 2016.
- [13] M. Smyth and B. Pearce, “Airline Liberalisation: Lessons from other industries on the impact of removing operational, ownership and control restrictions,” 2007.
- [14] Sabre Airline Solutions, “The Evolution Of The Airline Business Model - Technology and business solutions that give low-cost carriers the freedom to grow their businesses as they choose,” 2010.
- [15] Boeing Commercial Airplanes Market Analysis, “Current Market Outlook 2016-2035,” 2016.
- [16] United Nations Department of Economic and Social Affairs, “World Population Prospects: 2017 Revision,” New York, 2017.
- [17] T. Stalnaker, U. Khalid, and A. Taylor, “Airline economic analysis,” 2016.
- [18] European Commission, “An Aviation Strategy for Europe,” 2015. [Online]. Available: [https://ec.europa.eu/transport/modes/air/aviation-strategy\\_en#package\\_detai](https://ec.europa.eu/transport/modes/air/aviation-strategy_en#package_detai). [Accessed: 01-Feb-2017].
- [19] European Commission, *European Competitiveness Report*. 2001.