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Aviation of the Future: What Needs to Change to Get Aviation Fit for the Twenty-First Century

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Abstract

The world around us has changed dramatically, particularly since the beginning of the twenty-first century, mainly due to the broad availability of the Internet. Inventions such as smart phones, apps, virtual face to face conversations, coupled with the rise of Facebook, Google, Amazon & Co. added a lot of speed to this development. The digital revolution empowers the consumer and determines ever increasing expectations. At the same time, latest tech developments such as artificial intelligence (AI), machine learning (ML), blockchain, voice and more create opportunities never seen before. However, the aviation industry to a large extent has remained stuck in legacy processes and their decades old technology. It also suffers from low profit margins. With a few exceptions, aviation management overall struggles on how to adapt to the real-time and agile environment. Digital transformation activities have started both in operational and commercial areas, but fundamental underlying platforms and culture change in most cases have not yet been addressed. This chapter explains reasons behind key pain points of the industry, what activities are ongoing and the main areas that need to change to get into shape for the current dynamic environment.

Keywords: digital transformation, change management, legacy processes, technology, agile, leadership, artificial intelligence, blockchain, customer experience, aviation, airline, airports, travel agencies, tour operators, airlines, airports, modern management, multi-speed IT, distribution, digitisation, sales, travel retail, technology, machine learning, data, digital cockpit, digital airport, digital airline, amazon of the air, travel retail, business model, strategy, aircraft on demand, travel tech

1. Introduction

The target of this chapter is to provide some glimpse behind the curtains, some results of empirical and cross industry research as well as my personal observations and experiences over time. I will focus on why the aviation industry has been slow to adopt the changes, give more background about the underlying problems and outline what activities are already happening and which are the four key opportunities which absolutely need to be tackled. This is not meant to be a complete list of what is happening in the industry, but rather about some of the game changers and critical success factors to bring about change, based on our extensive experience and insight over the years as well as ongoing market research. I am not tackling

sustainability, even though I think it is a key problem that needs to be addressed separately, not just in terms of the impact of fuel consumption but also in terms of the amount of plastic created during each flight, the airport operation and impact on the environment, and the problems of over-tourism.

Let me start with an illustration of the as is situation by pointing out some of my recent travel experiences. In June 2018 I travelled from Switzerland to the US as I was a speaker and judge at a big travel tech event in San Francisco. During the flight I had to use internet as I still needed to send an urgent email. When I asked the flight attendant why internet was not working she shrugged her shoulders and said she did not know. 2 h later I tried again and finally managed to send my email. At arrival in San Francisco the queues for passport control were so long that people could not get off the running walkways. It took more than 2 h to get out of the airport. I had to continue my trip to Asia before going back home. I tried several times to book a ticket directly with a large Asian carrier, but I could not complete the process as the payment options did not foresee any European credit cards. I was forced to book with an online agency instead, and their booking process did not allow me to book a seat. Lost seat revenue and higher ticket cost because of agency commission are what this meant for the airline. For me it meant a lot of wasted time and frustration. On the last part of my flight back to Switzerland, a woman from Chicago sitting next to me was crying as she had lost her previous connection and had been running so hard to get on this flight—as missing it would have meant an overnight—that she had left her laptop bag in the aircraft. The airline crew at the gate was very unfriendly with her, and she felt completely helpless. She was visiting her boyfriend in Switzerland for only a couple of days, and while the super friendly flight attendant had already been able to tell her that her luggage had been found, it only finally arrived at her boyfriend's address several days after she had already been back home in the US. It took her several phone calls and being stuck in waiting lines to contact centres to get there.

These experiences contrast sharply with a world where I write invoices with my mobile phone, buy products and services at Amazon and Alibaba with one click, switch off the light at my home by talking to Alexa, answer my doorbell even when travelling thanks to the smart doorbell Ding, order a present for my Mum online and let it be delivered to my car's boot, get flight status updates by just entering a flight number in google, order my dinner for my late flight via app, for pick up at the airport restaurants or even gate delivery. Where do these visible problems come from in an industry which in its early days had so much pride in customer service and innovation?

2. The state of the industry: and why flying can be so painful

The aviation market has always been quite volatile. Even going back to regulated environments airlines have gone from a wave of positive results to huge losses. They have been extremely exposed to external factors, from new legal restrictions to fuel price change and politic and economic impact on demand for air travel. Airports as being even more capital intensive have seen their performance as a consequence of airline decisions. The rise of the low cost carriers was not taken seriously initially by the full service traditional network carriers before they reached significant market share and started to enter the lucrative long haul sector as well.

2.1 Airline profitability

For the aviation industry dependence on external factors such as fuel, labour cost, the political environment and economic growth factors has always been

extremely high. The Gulf war illustrated this very clearly, as did the rise of low cost carriers in the 1990s, 11/9/2001 and the global economic crisis starting in 2008. These events led airlines to rethink their aircraft ownership or lease strategies as well as increased focus on their cost structures. Ryanair as a game changer for the European and global airline market had turned to the low cost model when facing huge losses and realising that they could only survive with drastic change. They questioned everything they did, aligned processes and product proposition and seized the opportunities which the broad availability of internet provided in terms of efficiency and customer reach without the necessity of large investments into sales infrastructure. They started to reinvent themselves again a couple of years ago with the introduction of significant customer service improvements "... and begin to manage those customers and deliver individually tailored service for them to meet their needs" [1], when realising the limits their model had reached.

The subsequent global growth of low cost carriers can be attributed to extreme cost focus and subsequent large price differentials to traditional carriers, frequency of service, flexibility to abandon routes if they do not perform, the rise in economic activity and increased internet penetration and e-literacy, increase in purchasing power of middle class households particularly in developing regions, ease of travel, urbanisation and changes in lifestyle and consumer preferences with the widespread availability of the smart phone and the control that the internet rendered to consumers. While many attempts at long haul low cost operations had failed, there has been some radical change in recent years, with Norwegian Airlines being one of the key drivers, attacking the main profit makers of the traditional network carriers.

The latter had already started in the 1990s to found their own low cost carrier. Yet as they did not let them develop completely independently they often failed and incurred extremely high losses as their cost structures and behaviour was too much aligned with what the airline group did. Lufthansa's subsidiary Eurowings is one example. Go by British Airways was sold to Easy Jet and latest attempts include long haul low cost with their subsidiary Level as a reaction to Norwegian Airlines' growth in the lucrative long haul market. Emirates is moving to an alignment of network and customer proposition such as their frequent flyer program with their low cost subsidiary flydubai after they had originally been independent. There are still more recent low cost carrier start ups by network carriers, for example Swoop, West Jet's new ultra-low cost carrier and flyadeal, Saudia Airlines' new low cost subsidiary.

In recent years, traditional airlines started to unbundle their service offering and followed what low cost carriers had been doing as part of their strategy: they added price tags for luggage, early boarding, hold fees and more. The interesting thing is that this happened in a period when the low cost carriers reached more maturity and started to enhance their customer proposition and to target business travellers with tailored services. This leads to the somehow paradox situation that network carriers still claim to offer more service, yet factually customers can choose their way of flying for much lower fares and not rarely better service with low cost carriers.

Low fuel rates, relatively high growth in demand for air travel (7–8% versus a 20-year average of 5.5%), growing seat load factors and the adoption of more and more ancillary services for sale helped to achieve a positive performance again for airlines in the last years. In some regions such as the US the intensive consolidation has also helped to increase average fares and thus total revenue. International Air Traffic Association (IATA) announced in June 2018 that it expects airlines to achieve a collective net profit of \$33.8 billion, with a net margin of 4.1% in 2018 [2].

This result is driven to a large extent by North American airlines, followed by Asia-Pacific and European ones.

However, this is a downward revision from the previous forecast and compares to US\$38 billion in 2017, mainly driven by increase in cost of fuel, labour and interest rates.

According to IATA [2], airfares keep going down. The 2018 average return airfare (before surcharges and tax) is expected to be US\$380 (2018 dollars), which is 59% below 1998 levels after adjusting for inflation. Average air freight rates for 2018 are expected to be US\$1.80/kg, which is 63% below 1998 levels.

An analysis of the Forbes Global 2000 list [3] gives some interesting insights in terms of financial perspective, particularly market capitalisation. Looking at the top 10, there is not a single airline or airport part of it. Yet for the first time since 2015, China and the US split the top 10 evenly this year. On the inaugural list in 2003, there were just 43 companies from the Greater Chinese Area. Meanwhile, Japan, the United Kingdom and South Korea also broke into the top five countries with the most companies.

In comparison to C-trip (which also owns Skyscanner) and Expedia, most airlines market capitalisation is in the best case close or much lower. In comparison to tech companies the gap is simply enormous. This is illustrated clearly in **Figure 1**. The one airline which does stand out is Delta, which is with US\$37.1 billion in a much better position to the other airlines, with the next best one being American Airlines followed by IAG. Delta's CEO Ed Bastian [4] has realised the role of technology as a competitive advantage-next to the people in the airline- and invests heavily. When adding airports to the list, it is interesting that Aeropuertos Españoles y Navegación Aérea (AENA) seems to come close to Amadeus' market capitalisation, while all the others are significantly lower.

If you compare airline value with some of its IT providers, then you realise that Amadeus as a key IT provider to airlines is worth more in terms of market capitalisation than the airlines Lufthansa, IAG/British Airways, Air France-KLM and SAS

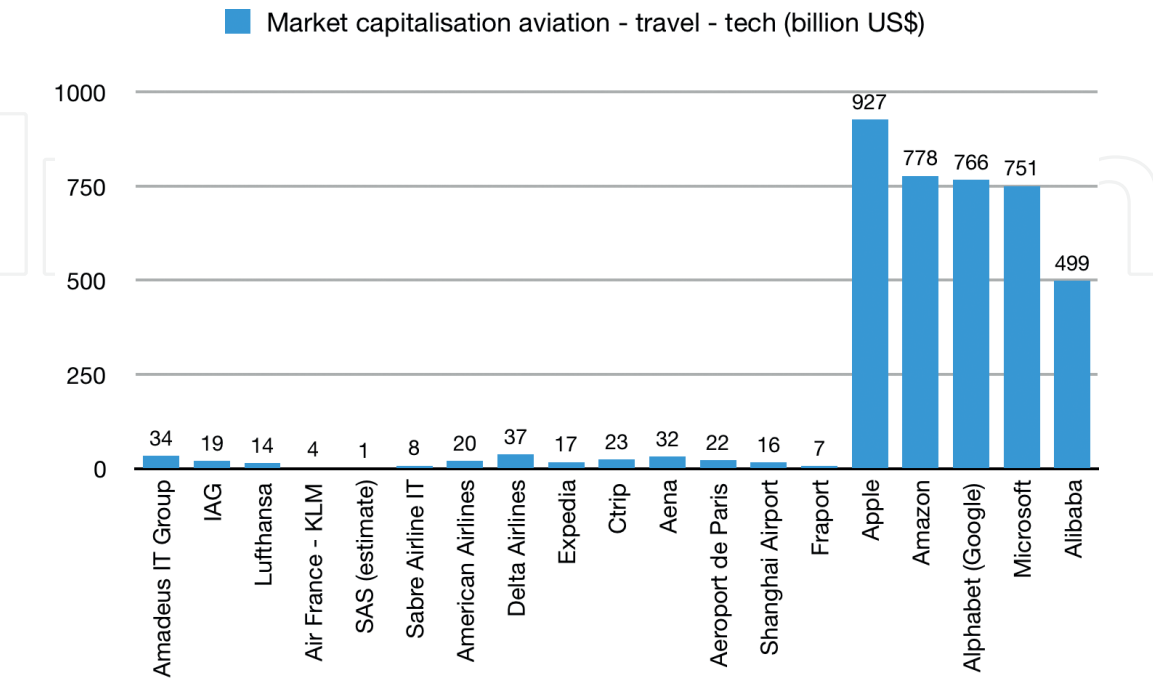


Figure 1. Market capitalisation (US\$ billion), extract 1—market capitalisation aviation and travel companies versus travel tech and technology companies overall. Data from Forbes Global 2000 [3], illustration by the author.

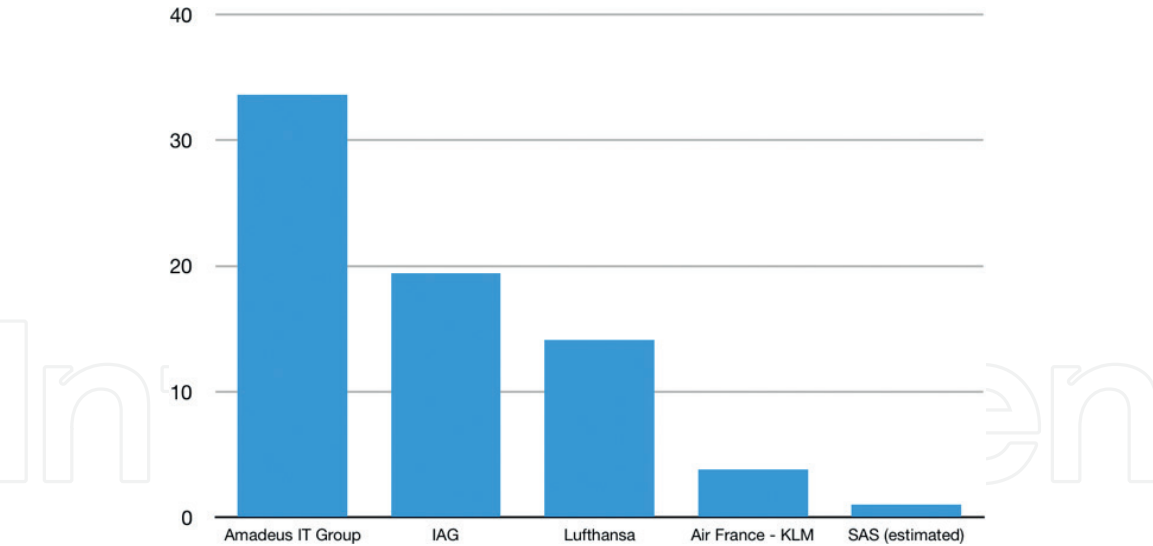


Figure 2.
Market capitalisation (US\$ billion), extract 2—Amadeus versus its founding airlines.

that originally founded it 30 years ago (**Figure 2**). In fact, decades ago airlines had been very innovative and developed their own IT to be able to handle reservations and the underlying operational requirements. American Airlines had founded Sabre, Delta had founded Worldspan, Lufthansa had founded Lufthansa Systems. Many more airlines globally had developed their own IT systems in the 1950s and 1960s predominantly.

Sabre, the equivalent provider of airline solutions to Amadeus that was founded by American Airlines in 1960 is estimated to have a market capitalisation between US\$7 and US\$8 billion. This compares to an estimated US\$19.9 billion for American Airlines [3], thus in this case the IT provider representing less than half of the value than the airline which had founded it.

For the complete picture it should be mentioned that the big traditional airline solutions providers Amadeus, Sabre and Travelsky have also a vested interest in the travel agency market by providing the Global Distribution System (GDS). They incentivise travel agencies to use their systems while they charge airlines for those distribution services [5].

2.2 Airline technology and processes

Given low profit margins and focus on operational issues and safety first, airlines in most cases simply have not had the money to invest in state of the art technology. But it is also—if not even more—the lack of priority of technology for top management. Most aviation leadership teams have been set up with more traditional management, where digital and also customer centricity had been underestimated and misrepresented. It takes a long time to change this mindset even when bringing in additional individual talent to adjust.

Airlines are used to iterative and process thinking, to a great degree influenced by legal frameworks to ensure a safe operation, but also by the decade old systems being in place and very much an inward looking culture. Top management had not realised the importance of digital. Ecommerce was evolving in a separate department with some specialists but had not really become part of the overall strategy until recently. The mindset of the workforce is significantly influenced by this process thinking approach, traditional leadership and the complexity and barriers of the current systems landscape.

Airline and airport staff often do not know why they do things. They just do it because it has always been done that way. And because their environment does not encourage questions. This leads to a number of pain points which get completely absurd in the current environment. Let me just give a few obvious questions as examples:

- Why do I need to check in? If I buy a cinema ticket or goods in the store, I pay and I get what I paid for without further validation
- Price levels for flights are restricted by numbers of letters of the alphabet instead of true commercial requirements
- Why can I not dynamically adjust change fees, e.g., by period ahead of booking, colour of shoes you are wearing, day on which you are making the changes
- Why can I not book luggage for me just for the return flight, a meal for my husband and priority boarding and a seat free next to her for my Mum
- Why do I get offered seats at check in even though I have already booked them
- I paid much for my seat, yet short term aircraft changes might mean I cannot get the seat anymore which I had reserved
- Why should airlines still spend time and money to load prices via the Airline Tariff Publishing Company (ATPCO)
- Why can I not book add-ons/ancillaries if I had booked the flight with tour operators
- Why are the additional services I had bought (seat, luggage, car) not changed as well when I make flight changes
- Why do I still receive these tickets with long text and lots of abbreviations
- Why can codeshare partners offer lower fares on the operating carrier flights than the operating carrier itself
- Why do airlines need codeshares when I could connect directly with the other airlines, which is also more transparent for customers
- Why do I not get offered more services by my airline for the airport & destination
- Why can I not start my booking on one device and continue on the other
- Why do I not just get the possibility to use the next available low cost flight if a network carrier cancels a flight ad hoc
- Why are there still cabins in the plane: one customer might look after the best seat to sleep, the other might want a good meal, etc.

- Why do I need to wait at the luggage carousel and the queue at the lost luggage desk when it is already known that my luggage was left at the departure location
- Why are data all over the place and not easily accessible nor comparable, making it very difficult for airline staff to really help to solve issues but results in fragmented processes
- Why do I not have one view of the customer but only data referring to specific flights
- Why do accounting systems have a different truth to other systems
- Why do revenue management systems still focus mainly on historic data and do not include real time information
- Why is it so costly and takes so long to make system changes, often inhibiting both certain commercial activities as well as realisation of service improvements and innovations

This list of pain points is just an extract. The pain points cover all parts of the customer journey, from trip planning to booking, experiencing and sharing. They are a result of continuing with processes and systems which had been created for a different environment, where internet did not exist and in which the technological possibilities were more limited.

The traditional systems landscape is extremely fragmented and complex, and many of the new elements such as the online channel, optional services for sale, mobile, self service for customers and staff, reporting, customer notifications had to be added on top of it as workarounds (**Figure 3**). And the traditional processes around this are still to a great degree manual and broken, and based on specialist

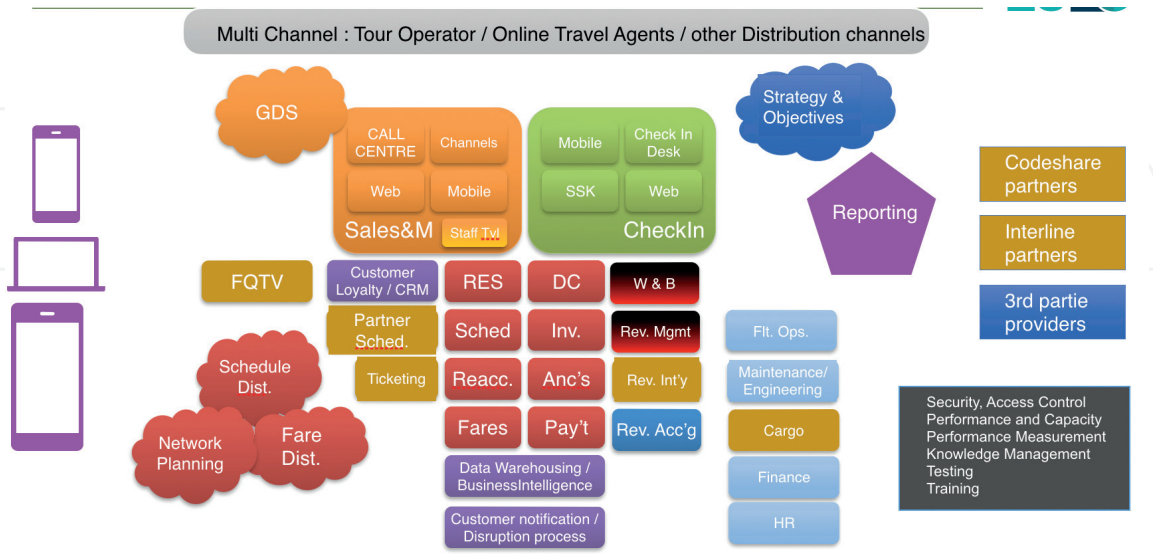


Figure 3. Typical airline IT architecture. Abbreviations used: GDS global distribution system, FQTV fare quote system, schedule distribution, fare distribution, RES reservations, Sched scheduling, Reacc. Reaccommodation, Inv. inventory, Anc's ancillary services, Pay't payment, W&B Weight and balance, Rev.Mgmt. Revenue management, RevInt'y revenue integrity, Rev. Acc'g revenue accounting, Flt ops flight operations, HR human resources, API application programming Interface, AI artificial intelligence, ML machine learning, IOT internet of things, AR/VR stand for augmented reality and virtual reality.

silos instead of a holistic approach. They were focused on transactions and had not put the customer in the centre nor did they target a seamless experience or have foreseen the commercial and competitive pressures that we encounter today [6].

There were a number of computer failures and outages in recent years and months, from Delta, Southwest Airlines, United to British Airways [7]. Part of the underlying reason are complexity both of systems and processes, with a large degree of legacy technology, and subsequent problems to find the error. The impact is even higher as manual or alternative processes are often not in case, leading to huge disruption for customers and the airline as a result. The underlying principles and processes had been standardised via IATA initiatives, in order to make cooperation between airlines and airports and travel globally easier. IATA in recent years took a number of initiatives to adjust them to better fit with the current age. Yet it is difficult to turn around a tanker, and these are small steps in comparison to what we would expect as normal in the current digital environment.

Technology spend by airlines and airports are estimated to have reached nearly US\$33 billion in 2017 [8]. This is almost exactly the total market capitalisation of Amadeus IT Systems alone. According to reference [8], top of the agenda for both airports and airlines are cyber security, cloud services and passenger self-service. Airlines' expenditure as a percentage of revenue was about 3.3% in 2017. For airports, the figure was about 5% for this year or US\$8.43 billion. For 2018, it is expected that at least the same levels are being maintained, if not increased. These investment figures do not seem huge given the digital agenda but rather look like maintaining status quo. While new technology makes it possible to take a smarter approach with much less money than aviation is used to, it first requires the investment in the change. Hidden in the average figures there are airlines such as Delta and Ryanair, which are investing heavily, while a large part just work on maintaining status quo and do the most urgent adjustments. Given the high amount of investment over time and the amount of people employed coupled with resistance to change, there are lots of economic interests by providers and some other stakeholders to maintain the status quo as long as possible. In a time when the only thing which is clear about the future is that flexibility is required, providers are still trying to achieve 10 or 15 years contracts and to even restrict some commercial flexibility with regard to distribution policies. There are first signs that some big airlines do not accept this anymore, with a particular breakthrough by Lufthansa and their introduction of a distribution fee (see also Section 3.3) (**Figures 1–4**).

3. What is being done: a selection of initiatives

We had some vivid discussions and lots of examples of current activities during our last annual global think tank “think future - Hamburg Aviation Conference”, bringing together top leaders, innovators and thought leaders from airlines, airports, rail, hospitality, other travel stakeholders, innovative travel tech and universities to discuss solutions how to succeed in the current dynamic environment. The live stream for this year's event can be watched on YouTube [6]. We particularly recommend the opening panel discussion between top leaders from airports, airlines and tech providers and the panel about the future for airports as additional insight to the following sections, directly from aviation thought leaders.

I think the good news is that in the meantime even the most traditional airlines' and airports' boards and executive teams have realised that change is not a choice anymore. But they struggle with the how, and what to focus on. I have summarised

a few activities by airlines and airports and selective other travel stakeholders, which I think give a good impression in terms of what initiatives are prioritised out there at the moment.

3.1 Structural technology changes

Delta Airlines- having declared technology as a key focus has brought in-house two key technology platforms, its reservations and passenger services system and its flight operations systems. These are old systems they have already been using, so there was no migration required. They bought the rights from their provider Travelport. Delta had owned Worldspan—which then became part of Travelport—back in the early days of the airline. By controlling these systems Delta hopes to not only be able to act faster but also to be able to develop one view on the customer. Virgin announced in August 2018 that they will launch a new loyalty scheme with Delta in an attempt to offer a joint scheme for their customers [9].

A few low cost airlines developed their own distribution and passenger services systems (PSS) to be able to achieve best possible flexibility, Easy Jet and Jet2 in the UK being key examples.

Some airlines have decided to choose one of the more recent players in the area of underlying reservations and operations systems—to note that “recent” is relative to the majority of the systems in use today, it still means systems which were founded more than 20 years ago—such as Radixx (founded 1993), Bravo Passenger Solutions (founded 1993) and the most recent one IBS Software Services (founded 1997). ITA software, which had started to develop a completely new Passenger Services System (PSS), was bought by Google for US\$ 700 million in 2010 as a vehicle for Google to further develop their travel capabilities. Since then, Google developed many features including Google flight searcher, directly linking to the relative airlines.

A number of older airlines which still own their own PSS systems—for example Aer Lingus, Iberia and Air New Zealand—are evaluating change to an external provider. The fact that this has not happened is a good example that some of them do not think that just moving to one of the existing external provider will solve their issues. The IAG group is an illustrative for this: British Airways uses Amadeus, but Aer Lingus and Iberia both still own their own internal system.

A number of airlines have also started to think about what some of the more modular systems and add on processes such as revenue management and network planning as well as group management and operations planning of the future should ideally look like given the changed environment.

3.2 Customer experience improvements and revenue increases

Customer self service activities have been a priority for a couple of years. It is now increasingly extended to other areas such as self connecting and additional servicing via chatbots. All types of airlines started to offer additional optional services, and also charge for them, particularly for seats and luggage and other ancillary services. Yet often this has been more of a panic activity to recover poor revenue results, and the experience is often not completely thought through, with failures in terms of luggage and seat delivery by the traditional airlines in particular as they own a diversity of aircraft types. The bundling of services is an attempt to facilitate the sales process, often determined by technology restrictions as well.

Latest attempts focus on data analysis and one view of the customer in order to be able to sell more personalised products and services. In addition, beyond the pre-departure and inflight services there is more focus on the airport and destination experience. The following selection is a result of our ongoing research.

Delta tackled the luggage delivery issues in 2016 and invested US\$50 million in technology so that travellers will be able to track their luggage via an app, from the moment they check their bags to the minute the bags arrive at their destination. For 2018, they focus on re-organising all their customer related data to achieve one view of the customer [10].

JetBlue has invested in Gladly through its venture arm, JetBlue Technology Ventures. Gladly is the maker of a customer service platform for various companies, including airlines, helping to achieve a customer centric service with one view of the customer.

Ryanair has started a project declared to become the Amazon of the air, as part of their “always getting better campaign”. As part of this initiative they have created a customer login—which has been in place with Easy Jet and other airlines for many years already—and keep adding optional service offerings related to travel [11].

IATA has initiated a number of projects to support the airline industry—particularly New Distribution Capability (NDC) and One Order to achieve a better view on the customer and enable sales of ancillary products regardless of which distribution channel is used.

KLM focuses on social media as a way to enhance customer service, but even as a sales channel. This initiative came about during the ash cloud, when they realised the difficulties of communicating with their customers via the limited contact centre channels, as a result of which many customers approached them via social media. They are strong with their social media proposition both in Europe but also in their key regions, adapting to local preferences such as we chat in Asia. However, they also realised that the actual operational delivery is lacking behind and announced recently that they have just launched a project and released significant budget to focus on this [12].

Lufthansa and United Airlines recently declared the development of a new digital services platform (DSP) [13] that will further align the Star Alliance carriers. So far, the travel experience for customers is still fragmented, in particular in terms of additional services such as seat reservation and luggage bookings. For example, they launched a seat selection feature in June 2018 which allows a United Airlines customer to select a seat on Singapore Airlines flights booked via united.com or the United App. It means that a customer can now select a complimentary seat for the entire journey at time of registration regardless of which Star Alliance carrier is involved. At the moment this is just possible at check in.

Airlines have started to introduce digital concierge services by using multi-lingual chatbot technology. Finnair and Sun Express are just a few of the airlines realising this as a way forward for better customer service around the clock and increased efficiency. It focuses so far mainly on information related to bookings, but booking services are in the making as well as adding voice. But it requires a process alignment first in order to add real value.

Seat resale and upgrade offering products that airlines such as LATAM have started to introduce are more examples how airlines can solve some operational problems due to overbooking and improve the customer experience as well as gain additional revenues.

Moscow Domodedovo airport turned itself into a shopping mall, thus attracting additional visitors and revenues. Many airports had traditionally only focused on the b2b customers. But in the meantime they have realised that they

do need to get better customer insight and to keep up with customer expectations. Airports such as Copenhagen, Heathrow and Dublin have introduced customer programs, in an attempt to allow for sales of additional services, customer insight and direct communication with the customer. Many airports have introduced services such as fast track and airport parking for sale online or via an app. Geneva Airport and most UK and Italian airports are examples. Also pre-order and pick up at arrival of duty free products has become a common feature. Yet it is still difficult to find exactly the retail offering at the airport ahead of your trip. But more recently this is being extended to include all the retailers at the airport, and even in town, with pick up at the airport, via an online sales offering for customers. The German company AOE have started to offer these services via their digital platform at Auckland and Frankfurt. Heathrow Airport have just announced that they will join.

Grab is an innovative company which allows to pre-order food at the airport and grab it on your way to the gate [14]. Their solution is already integrated in a number of airport apps or websites, for example London Gatwick and Heathrow Airport adopted this offering. As airport food and beverage offering have improved significantly this could become a solution to the poor quality yet high cost for the airline of offering food during flights. American Airlines and a couple of other airlines have already decided to include this offer in their customer proposition. Airlines just need to have the open mind to test this as a complete solution for food on board. Hamburg Airport has just introduced a test for preorder and delivery of breakfast at the gate, thus saving valuable time in the morning for their customers.

Amsterdam Airport and Hamburg Airport tested in 2018 improvements for the customer experience through the PASSME [15] project, which uses technology and some airport design elements to reduce the unwanted travel time and helping to spend their time according to their preferences. Tampa airport introduced a program to get more customer insight and build an action plan for higher customer satisfaction, making use of technology to support the process. Incheon/Seoul Airport have extremely efficient biometric identification at security control, which speaks to the customers in the language of their passport.

Other travel stakeholders have also done an enormous amount of customer experience improvements. Transport for London created a unified API to allow a more seamless travel experience for customers [16]. The German rail operator Deutsche Bahn improved their customers' experience by turning the DB navigator into a travel concierge, allowing clients' time to be spent effectively and according to their priorities instead of wasting it with travel planning [17].

Expedia have adapted a completely agile approach in terms of testing which websites and costumer propositions work best. They also experiment with Voice by developing a number of solutions for Alexa by Amazon [18].

Kayak and Expedia have all started using chatbots that can learn what consumers like and deliver appropriate suggestions for travel products to buy. American Express just bought Mezi, which is a personalised travel assistant based on AI supporting business travel agencies to offer multiple services for their customers, including "please just buy the same flowers as every week".

3.3 Efficiency increases

Low cost or hybrid carriers such as Virgin Express and later Brussels Airlines had already worked with surcharges for more expensive channels more than 10 years ago. These were relatively small carriers in the global context and therefore did not create much awareness or subsequent change.

In 2015, Lufthansa announced a 16-euro surcharge [19] on each booking made through global distribution systems (GDSs) like Amadeus and Sabre. Other carriers such as British Airways and Air France followed. They want customers to book directly through their websites to be able to get a better customer understanding, control their experience, offer ancillary services for sale and introduce more flexible pricing as well as ad hoc offers at the airport as for example lounge access. And they aim to control the high direct and indirect cost created through GDS bookings.

Airlines and airports are increasing the focus on self service. This leads to the increased availability and push of self service luggage check in, as Air New Zealand and Lufthansa have had in place at their home airports for a couple of years. Self connecting services to simplify connecting traffic and enable connections with low cost carriers have started to take ground since Easy Jet announced cooperation with long haul carriers such as Norwegian and West Jet [20], and Air Asia introduced a special product for this.

In Japan airports are testing robots to carry heavy luggage and to clean airport premises. Munich Airport in cooperation with Lufthansa is also running a pilot to test Pepper, the humanoid robot to answer customer questions at the airport [21]. Fraport introduced the “Smart Data Lab”, in an attempt to gain useful knowledge and insights and be able to take action from the data in the organisation.

3.4 Organisation design to incorporate digital, retail and innovation

Some changes in terms of realising the importance of digital and innovation have become visible in the organisational setup, both in terms of new functions and an increased presence in the top leadership. Titles such as Customer Experience Director, Digital Transformation Officers [22], Digital Officers and Innovation Officers or Directors have become quite common. Dependent on the stage of the organisation, digital is often still seen as an add-on, which becomes visible in titles such as “digital customer experience” and / or separate functions for ancillary services and loyalty instead of taking a holistic approach. “Retail” has become part of the nomenclature in organisations in some airlines and is already very common in airport organisations. Some organisations, in an attempt to stress the customer focus, have also renamed operational areas, for example “airport customer delivery” instead of “ground handling”.

However, the main base of the organisation is still very similar to what it used to be, even though the functions and activities should change as they are not really aligned anymore with the current world. Revenue Management & Pricing for example is becoming increasingly mingled with digital channel pricing and sales, ancillaries and loyalty services overlap, digital channel experience and customer experience overall overlap and so on.

Throughout my career I have noticed that aviation companies often prefer re-organisation instead of tackling the key problems of revising processes to be fit for the future, assigning and building the right talent and departments working in silos.

3.5 The rise of innovation labs

Both airports and airlines have started to take initiatives to foster innovation via innovation labs.

To name a few real life examples from the airline world:

- Easy Jet puts disruptive thinking at the heart of its digital strategy and invested in Founders Factory [23].

- Ryanair established Ryanair Labs as an internal solution as part of its “always getting better” campaign.
- Lufthansa created the Lufthansa Innovation Hub as a separate subsidiary.
- IAG, in partnership with L. Marks, launched the Hangar 51 program in 2016 to help improve airport processes, digitise business processes, improve data driven decision making to enhance customer satisfaction and to develop completely new innovative ideas that can make a difference to customers.
- Jet Blue created a venture arm to foster innovation, Jet Blue Technology Ventures.
- Malaysia Airlines has launched its first in-house innovation lab last year. It is called iSpace. Malaysian claim that the opening marks the third phase of its digital transformation. Tata Consultancy Services, IBM Bluemix, Amadeus, Telekom Malaysia and University of Malaya are partnering with the airline in the initiative.

But also airports are taking attempts to innovate and support digital transformation. There is a lot of potential through digitisation to speed up and increase efficiency for processes and to develop new experiences:

- Manchester Airport Group have launched its own technology and e-commerce business to respond to technology-driven changes in the way passengers travel. They want to move the airport experience into the digital age.
- Group ADP (Paris Airports) launched the “Smart Airport” innovation hub initiative to design the airport of tomorrow.
- Munich Airport has recently announced the development of a future focused innovation campus.
- San Diego International Airport’s Innovation Lab is a collaborative environment where companies, innovators and airport executives work together to create and test new ideas. The aim is to drive airport innovation and improve the customer experience. Successful ideas have the opportunity to be implemented at San Diego, other airports, and even in other relevant industries like malls, hotels, convention centres, etc.

Made by many, a digital innovative agency in London has done research on innovation labs, with a broad collection of best practice knowledge ([24], see also **Figure 4**).

They look at four main experiments related to innovation labs: the impact of proper design, the impact of actual competition, the impact of hard targets and the impact of tranquillity. The report reveals plenty of valuable insights and data, about where the blockers to innovation are, what innovation lab talent looks like (and how to manage it), how to integrate with the sponsor organisation, and why innovation labs are to business what science-fiction is to literature. Above all, and perhaps most valuably, made by many defined the key reasons why innovation labs fail, and what critical success factors are. **Figure 4** is the summary of the key learnings from the report.

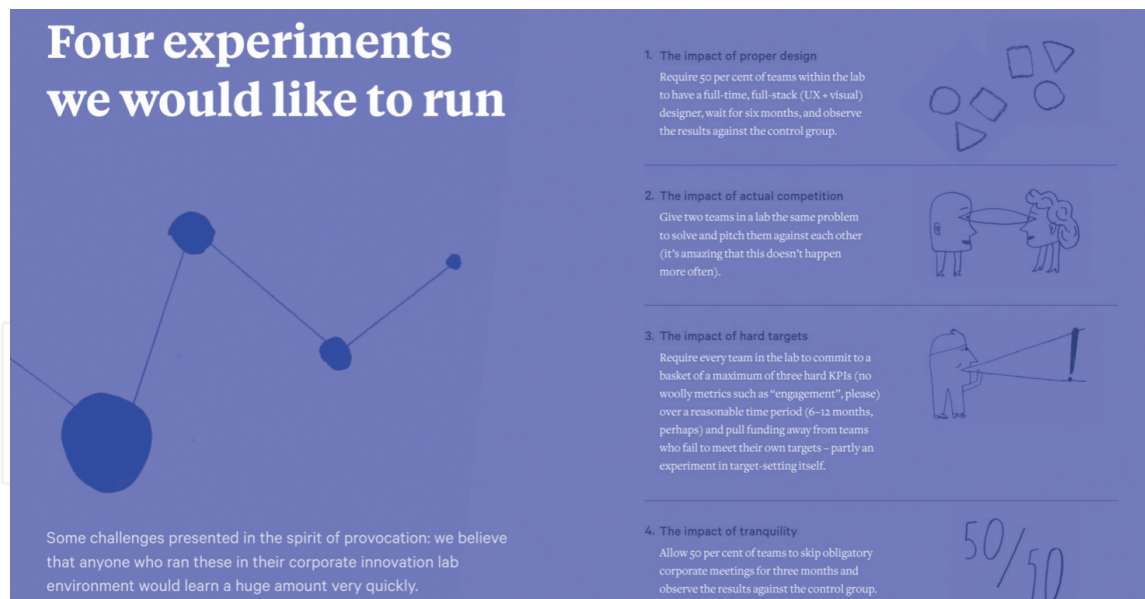


Figure 4.

Made by many, Kevin Braddock: *Innovation labs—best practice, main conclusions; madebymany.com*

IATA have started to support aviation by running hackathons to develop innovative solutions based on the IATA standards such as New Distribution Capability (NDC). These hackathons help to show what can be done to achieve the culture change so much needed in the industry. Unfortunately airlines are not yet making enough use of these possibilities.

3.6 Innovative things in the making: newcomers, innovating and disrupting

New technology and fresh thinking can help significantly to challenge and improve the current way of working, current profitability models, customer and staff experience, operational and commercial areas. It would be beyond the scope of this chapter to go further into details, but just showing some of the revolutionary developments in the market gives an idea of the possibilities.

A number of solutions help to overcome the silos within organisations and also foster more open thinking with external partners. In particular airports and airlines have missed a lot of opportunities because of building frontiers around themselves and not cooperating closely.

We outline a number of innovations from travel tech start ups and enabling technologies that reflect new thinking—not only new technology for old ways of doing things.

3.6.1 Augmenting customer experience and making travel planning easier

- Group Travel digitise the process of group bookings, reducing manual work and allowing to include a lot of additional services, facilitating the cooperation within the organization and between tour operators and airlines
- Trvl Porter: a style concierge recommending wardrobe for travellers to rent and making it available at their destination, no need to carry luggage any more
- AirPortr offers the service in London to pick up/deliver your luggage from/to your home or hotel and check it in for your flight

- Bounce is a start up allowing travellers to store their luggage with hotels and retailers whenever needed
- kiwi.com—helps to find all kinds of flights and develop a journey including low cost and full service airlines as well as other means of transport; they operate a contact centre as well to support customers in case of any operational disruptions
- TrustaBit uses blockchain technology to allow airlines to automate the compensation process, including the possibility to distribute vouchers during disruptions at the airport
- A number of inter-modular solutions such as Rome2Rio evolve, for airlines these solutions and new technologies make it much easier and less complex and costly than today to partner with other airlines, local taxi companies, and even boat taxis or bicycle rentals in order to get travellers exactly where they want to go and how they want to go there
- Boni Loud Steps developed indoor navigation for the visually impaired
- Interes is an innovative retail engine which helps airlines to develop and control dynamic product and promotional approaches adapted to their target groups, with pricing with no limits of the traditional systems related to fare filing or letters of the alphabet
- Hopper predict future price evolution and advise customers when best to book; they also offer alternatives to the destination chosen in line with customer preferences and budgets
- Grab allow mobile (pre)ordering for retail products and services at airports

3.6.2 Faster, more efficient, more revenue

- Automated aircraft checks conducted by robots and AI will speed up the turnaround process considerable, helping airlines to plan more efficiently
- New technology, such as 3D printing, offer new aircraft and engine design opportunities
- Data can be used to anticipate customer numbers in order to reduce crew requirements and engine maintenance, allocating the most suitable aircraft, or the most suitable gate at the airport even in case of delays. This allows more efficient staff planning. Beontra is one of the companies which developed models for integrated capacity, traffic and revenue planning to already achieve this in terms of airport planning
- Winding Tree is a start up allowing safe direct transaction with third parties by using blockchain technology, this can also help to foster the airport—airline cooperation
- YieldIn is a revenue management solution making it possible to align business priorities and revenue management practices, thus overcoming silos and ensuring engagement by top management

3.6.3 Safer and/or more sustainable and eco-friendly

- Helmets are being developed that include an augmented reality (AG) display. Pilots will be able to track all of the controls, alerts, signals, etc. more easily. Training will become more immersive as well as a result.
- The solution via Trvl Porter to “rent” your clothes at the destination saves fuel and thus is a more sustainable solution than carrying luggage.
- Further enhancements for “self flying” using AI and Machine Learning are in the making.

3.6.4 Substitutes on the horizon for current aviation models and processes

- What if Google, Amazon, Alibaba do move forward even more into travel and re-invent the whole model?
- Amazon had made some advances into travel some years ago [25] and stopped the initiative, yet technology has advanced even more now and they might give it another go given their expertise in online frictionless retail and 300 mn customer base [26].
- Alibaba has already shown significant muscle to play a major role in the Chinese travel market in spite of a strong player such as Ctrip. With their investment in a new brand Fliggy based on their Alitrip infrastructure they target the younger digital generation and have created a kind of travel marketplace, allowing travel players to create their own shop while providing marketing and data analytics support for airlines and travel players. If they combine this even more with their retail expertise and innovation activities this could potentially become a game changer.
- Google keeps adding elements of the travel journey, linking already to a number of airlines directly via Google flight search and adding travel partners to Google Maps; could they become the GDS of the future?
- Could there be completely new players in the market? What if there was just a market place for retail services and modular web based services to resolve inventory, wiping out a lot of the current processes?
- What if the principles of easy flying - which we still tend to call low cost services - becomes the norm for both long-haul and short-haul travel?
- If check in was eliminated, what would the large check in areas in airport terminals be used for? Could the stores just become mobile and move around the airport - where the customers are instead of directing customers to the stores? Will the order of food & beverage turn into delivery at gate services via robotics?
- Waves as a model for “flying on demand” is a start up which does already operate in the UK.
- Electric and hybrid engines and models will support new models such as “flying cars” and revised Concorde.
- Hyperloop as an alternative to longer distance travel.

4. What still needs to be done for the industry to survive

As seen just with the selection in Section 3 there are a number of activities ongoing in aviation to adjust to the digital age. Are they really the right things? Are they enough?

From an external view a lot of these activities seem to be little things just to get to the “normal” standard of today, and it is hard to understand why they take so much effort. And real structural issues seem to be missing. If your house is dump, just adding some high quality paint on top of the dump walls will not help. If you drive a vintage car, you will not normally use it to drive on the motorway, unless there is an emergency and you know you will be driving far too slow.

Digital innovation by Google, Amazon, Facebook, Apple, Samsung, Alibaba and other tech players but even other travel players such as online travel agents and meta search companies Expedia, Skyscanner/Ctrip and various new start ups has been out pacing the rate of change in aviation for several years, and the speed is accelerating, putting airlines and airports at a disadvantage to other industries and even to other travel stakeholders. The Forbes 2000 [3] list examples from Section 2 and the profitability and market capitalisation figures are a clear result of this (Figure 1).

Potential substitutes as described in Section 3.6.4 could become a real threat or simply a driver for faster and more drastic change. Coming back to the house example, it is as if avoiding to go to the basement because you know that it is full of water and old wiring and fragile walls, but you restore your house above and ignore this, hoping you will be able to continue as long as possible.

More drastic change is needed than copying current business models such as ancillary revenues or putting more focus on the customer and adding technology workarounds to make this happen. But only a few airlines and airports are really serious about it, starting to go down into the basement.

Sir Tim Clark, Emirates Airline president expressed a warning recently in an interview with Business Insider. “Guys, there’s a storm coming, and if you don’t get on it and deal with it, you will perish,” Clark said in a recent interview with Business Insider. “The company of the 2050s will bear no resemblance to the company of 2018.”

“It’s not a question about using advanced technology to increase the way you do your business, like ancillary revenue streams, because that’s a given,” Clark said emphatically. “It’s not a question of not knocking your companies down internally and rebuilding them on digital platforms. That’s a given for us. It’s not the case for a lot [of other airlines].” [27] Tim Clark made a major change by hiring a high calibre Chief Digital Innovation and Transformation Officer into his team end of 2016.

I believe there are 4 key areas which need to be tackled more seriously to really create a sustainable future for aviation. The model with the 4 Bs that we created is not iterative or a once off thing to do, but is meant to be re-applied on an ongoing basis, referring back and forth between the different stages and continuously evolving (Figure 5).

4.1 Big vision

The activities that airlines and airports currently perform are in most cases not part of a holistic strategy. They do add certain capabilities, without questioning enough the current processes and set up. If you see the tremendous amount of change happening outside of the industry, it is certain that consumer expectations will increase even more significantly.

More drastic change is needed

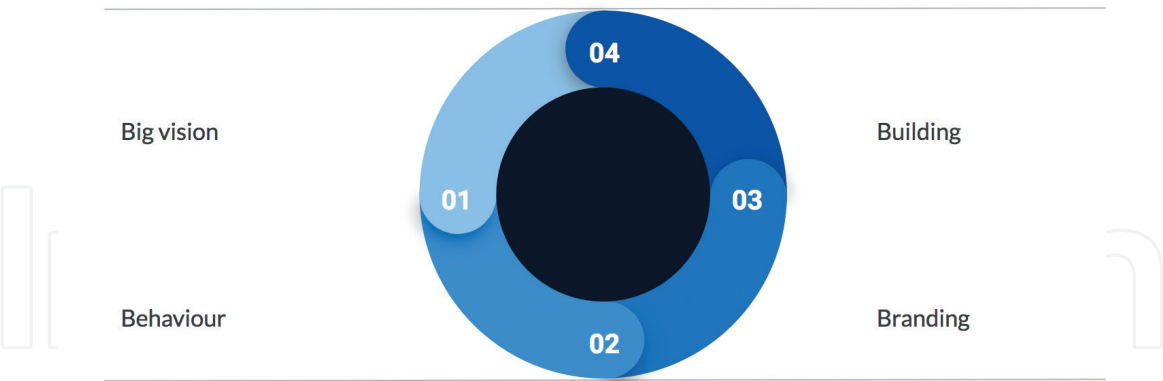


Figure 5.
The 4 Bs model, XXL Solutions.

Digitisation and technology based on digital platforms are a must, not even part of any vision any more.

A big and bold vision, starting with “greenfield” thinking and how you would set up an airline/airport without considering current processes. Only subsequently you would decide which of the current processes to eliminate completely, which ones to improve, which factors to build on and enhance in order to get closer to your vision.

Some airlines such as Ryanair have claimed they want to become the Amazon of the air. But Amazon has been continuously re-inventing itself, and is again doing so now with their Amazon Go stores, moving forward into the food supply chain and the internet of things (IOT) with Amazon Echo.

For airlines, their retailing ambitions so far are mainly based on adding ancillary services and optimising revenue and using more data analysis. And it seems each one is just following the others. Yet decade old technology and manual processes in distribution, revenue management and even operational areas will not provide the flexibility anymore to be ready to adapt. Unfortunately there is not the one technology solution out there to choose from, which delivers all the possibilities and flexibility needed today. But there are all the technological opportunities to implement a vision, without the complexities and large investments needed in the past.

4.2 Behaviour and mindset

A complete makeover is needed—including sorting out the basement of the house, or building a completely new house.

To develop the big vision and the subsequent makeover strategy requires above all the right leadership and mindset. And a lot of energy and care. When Ryanair re-invented the way of doing business in the 1990s their biggest risk was to have to close down. They questioned everything and used the opportunities of technology. When Willie Walsh turned ailing Aer Lingus into a low cost carrier at the beginning of this century he put very bold targets in order to achieve change and the thinking of what is needed to get there, even though it seemed far away and impossible at the time. West Jet as one of the global carriers with double digit profit margins for years as a very charismatic leader at the helm.

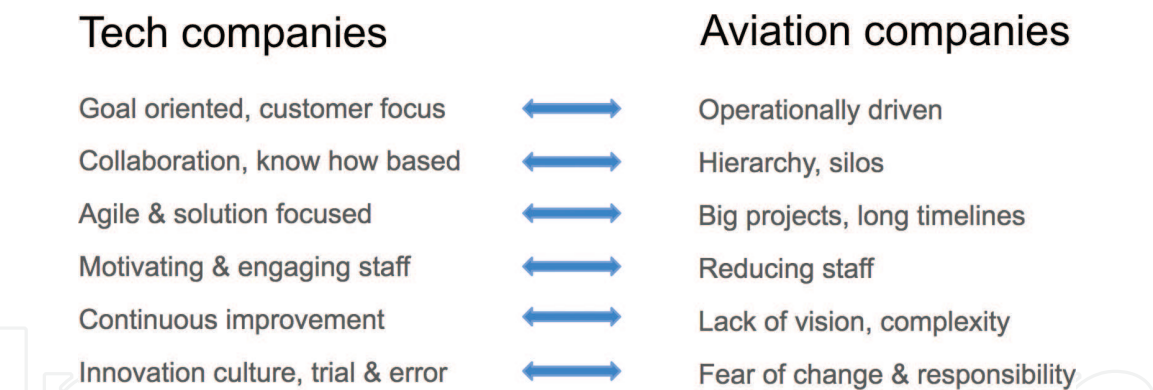


Figure 6.
XXL solutions, what aviation can learn from technology companies.

The big opportunity is that technology today allows to do everything we want to—it just requires a smart approach and a big vision to get there, which in turn requires the right behaviour and mindset.

If you look at how successful technology companies are, it helps to step back and think a bit about how they work and what aviation can learn from this. In **Figure 6**, we have pointed out some of the main relevant differences between the two types of businesses. Even though they are not always completely evolved, the tendencies in terms of behaviour are very relevant.

We believe that a change of behaviour and mindset is crucial for airlines and airports to achieve any change. The current prevailing iterative and process oriented style is counter productive for the dynamic and agile digital environment. Developing an agile approach, collaboration and using best talent related to a project rather than the one who should be there according to hierarchical thinking is a key element of success for tech companies but not yet for aviation. Trust and personal responsibility are at the heart of this behaviour.

The following elements can help to create this behaviour:

- A. **People and talent** are key. It requires a full review of the talent required to meet the digital and innovation requirements. You can only think out of the box if you have different boxes. Bringing in some younger people (for example by working with universities, for recruitment of new jobs or ad hoc activities) and creating more diversity to ensure more out of the box thinking coupled with training and support for existing staff to support change can help to speed up the digital transformation process. It is important to ensure that these people are really involved and can value. I have often seen some really good talent being left aside because of organisational dynamics. Travel brings together people with all kinds of different lifestyles and cultural background, yet airports and airlines are still very much national/local staff apart from the flying staff. It has also become very evident when looking at the picture of the airline CEOs at the last IATA Annual General Meeting (AGM) in Sydney that there was only one woman present.
- B. **Visible changes** such as collaboration tools like Slack, Facebook for work and introducing methodologies such as design thinking and Kanban can help to support the cultural change and to break down silos. Creating time, for example Fridays or 3 h per week for innovation, making use of co-working office space can help to grow with lower cost and foster an innovation and change culture and open minds. Even innovation awards—with simple rewards such as having lunch with the CEO could make the focus very visible.

- C. **Events and thought leadership from external sources**, or which training to do to look out of the current boundaries and comfort zones can help to develop the open minded behaviour needed. Aviation tends to shut down even more in case of high result pressure. Many airlines had initiated a stop on travel activities in recent years because of result pressure. In my opinion this is exactly the opposite of what should be done in the current environment. Disruptive events such as hackathons, travel tech start up events, tech and retail trends events and innovative think tanks should be used strategically to help board members, executive team members and other staff members think out of the box and develop their agenda for success. Even inviting thought leaders to do a presentation about trends in the marketplace and what it will look like in the future is something which can add to out of the box thinking for the whole company. Also Coursera, iTunesU, Udemy or edX offer opportunities for staff development and training which did not exist before—and had traditionally been extremely expensive and not personalised.
- D. **Define standards how to work**. This should include the principle of collaboration, agile behaviour, fast results, allowing trial and error, and to ensure to choose state of the art suppliers and do not just exclude them because they do not yet have enough customers. We are in an environment now where there is no fixed roadmap but a lot of possibilities, but it needs to be determined by the aviation stakeholders. Truly innovative suppliers and partners can help to foster innovation and open mindedness.
- E. **Putting yourselves into your customers shoes**. I have seen it too often that they had no clue what happens at the airport, or on the website, as they booked in a different way and were never asked to talk to customers or make observations at different touch points of the customer journey.

Obviously, being close to customers and understanding their mindset is one of the keys to ensure the right behaviour. If customer satisfaction and feedback become part of the board meeting agenda and the executive team meetings, and technology—which is already available—is used to analyse it and immediately direct it to the right people to take action, then this already key to realise current and future needs to satisfy customers. Tesco, the UK retailer, have also created household panels and feedback opportunities at specific touch points to really get a 360 degree of customers and realise trends early.

4.3 Branding and selling

Branding and selling is meant to be both for internal and external purposes to drive change and help staff to engage and fully understand what their role is, and to retain existing customers and create awareness for new ones. It is what companies often forget; they start building a new house first and create fears as staff see the preparatory works. Ryanair's "always getting better" campaign and the vision to become Amazon of the air is a good example of initiating a major change process to reinvent themselves and establish a new market positioning.

Their fast activities and visible results are the "moments of truth" and significantly help to make people belief in the change.

Change is always linked to fears, in particular in this fast changing environment. Fears of losing their jobs because of functional changes or introduction of AI should be foreseen and rather thought about ahead. Addressing those

fears, defining where human intervention can add value and start foreseeing these changes can make a significant difference. If staff are taken seriously and get engaged they can play a key role to turn around the company and establish new value—and revenue—adding functions while digitisation and optimising others.

I also believe that leadership should put themselves more often into the shoes of staff in addition to customers to be able to best understand the sentiment and act accordingly.

4.4 Building

The aviation industry has typically been extremely process oriented and risk averse, with big governance structures, also when it comes to running projects. A focus on results and agile behaviour is another thing which aviation can learn from tech companies in terms of how to run projects. Coupled with supporting new ideas and taking bold risks as part of the eco system, but abandoning when realising that it will not work out as predicted is crucial.

Methodologies such as design thinking [28] and Kanban help to design and run projects and achieve fast solutions in agile environments versus discussions without decisions over long periods of time and cumbersome governance structures for processes taking away empowerment of people. They can also help to ensure to draft processes which take account of future needs and allow flexibility rather than just reproducing similar approaches to today with new technology.

It is important that this approach is being understood and clearly becoming alive. It also involves taking some risks and creating a culture of trial and failure.

There are solutions in the market now which help to overcome some of the shortcomings of the old technology. If those solutions are adopted in a modular way, then gradually the unnecessary elements of the old systems can be phased out, and ultimately a truly state of the art proposition be in place, with well managed risk.

At the moment those innovative solutions are often ignored by airline people because they cannot yet imagine this new world. It is crucial for leadership to ensure that they take a leading role in guiding the organisation to do things differently. The biggest risk in the current environment is to not move.

4.5 Limitations and further considerations

Aviation is at a turning point. Changing consumer behaviour and customer expectations, rise of middle classes in developing economies, the global political landscape, environmental concerns and technological development lead to a dynamic environment and challenges never seen before.

Digitisation leads to a large scale of transformation across multiple aspects of business. It creates enormous opportunities, but also represents risks if not managed properly. The strategic implications for organisation, industry ecosystems and society have not yet been fully grasped by business leaders nor governments. Digitisation creates new challenges not yet fully understood. They include the pace of change never seen before, cultural change, the impact on society and identification of skills needed, outdated regulations, how to overcome legacy systems, the need for funding of both digital and physical infrastructure. Industry and Governments leaders need to take up the challenges in order to ensure that the potential value for society and industry can be leveraged. The question of the

value of digitisation for aviation, travel and tourism is estimated to reach up to \$305bn between 2016 and 2025 through increased profitability because of higher productivity, increased demand for products and services due to personalisation, sharing models and further improved perception of security. \$100 billion (bn) of value are expected to migrate from traditional to new players in the industry (for example from traditional travel booking intermediaries to OTAs). \$700 bn are the expected value for customers and wider society because of reduced environmental footprint, cost and time savings for travellers and safety and security improvements [29].

4.5.1 Customer experience

Travellers will expect a seamless experience tailored to their habits and preferences. Companies in the travel eco ecosystem along the customer journey will exchange data via secure technologies and continuously create insights. Travel will become frictionless and gradually blend with other daily activities. Digital technologies will augment the customer experience and the aviation workforce. Artificial intelligence (AI) and Machine Learning (ML) will help to turn data into insights and improve the customer experience, in the form of personalisation and chatbots, as well as take over specialist tasks of staff and transform the workforce. In addition, digital platforms, connected devices (Internet of things IoT), Virtual and Augmented Reality (VR/AR) and other technologies will allow for innovation, better customer experiences and increased efficiencies, and lead to a complete revision or erasure of legacy old processes. With digitisation of identify increased collaborative efforts need to be taken to ensure cyber security. The example of British Airways hacker attack on customer data in August 2018 is a good reminder of how real this threat is. Closely linked are fake news and fake revisions and evaluations of services via social media platforms.

4.5.2 Jobs and skills

The greatest societal impact of digitisation is probably the impact on the workforce and estimated to represent 1 in 11 jobs in the aviation and travel industry world wide according to the World Economic Forum study referenced above [31], potentially a number of 780,000 traditional job losses in the aviation and travel industry. Digitisation and new technologies will also mean displacement of current jobs in the industry, expected to be partially offset by next generation skilled jobs inside and outside aviation at the high and low end of the economy (for example in the area of robotics, Internet of Things (IoT), data analytics). All of these pose questions about future workforce which need to be addressed by industry and governments alike. New thinking is needed with regard to views on employment by society, concepts for next generation jobs and next generation occupation and pass time of people. Middle-level jobs that require routine manual and cognitive skills are the ones most at risk in terms of labour displacement and productivity effects [30]. Big legacy companies in particular struggle with the challenges of identifying new functions and redesigning organisation to integrate new and current functions in a way which suits the current dynamic environment [31]. Most departments have been run in silos, and staff fear about losing recognition and their jobs. Training programmes working with new technologies and helping to update relevant skills are required.

Top executives and board members have often been far away from digital and technological developments, and these areas have been specific entities in the

organisation. It is a big challenge for these leaders to open up and learn fast about the relevant technologies they need to consider, what their set up should look like and strategic options and tactics how to get away from their legacy systems and processes. I have heard from many personal discussions with people within these organisations that many change activities do not go ahead as they should as leaders lack the insight and thus courage to decide to go ahead with radical changes when they get opposition from some people within the organisation.

4.5.3 Legacy systems

Airlines in particular but also other aviation and travel stakeholders face limitations in their activities and speed of transformation as they need to keep legacy systems running while developing new technology. They are afraid of the risk of changing the underlying legacy technology. Yet there are new technologies available now which could help to develop an environment for the “new world” for specific routes only as a test case and to get confidence while keeping the legacy systems running. Such a multi-speed approach to information technology (IT) requires strong leadership to move ahead successfully. Other limitations often encountered are the fact that technology and the knowledge going along with it had been outsourced by main players for many years. It is essential to develop some in-house knowledge and skills even to be able to understand and manage IT suppliers better. Innovation in terms of technology often happens much more with smaller suppliers in the aviation and travel world, which leads to the question of small versus large suppliers in the eco system. Aviation stakeholders have often feared being exposed to smaller suppliers, and bigger one-stop suppliers have fostered this fear, yet the current environment asks for new approaches and a critical review of the choice of a supplier in terms of innovation potential.

4.5.4 Regulation and legislation

The regulatory framework has a significant influence on transformation and can encourage or discourage the introduction of new technology. Innovation moves much faster than regulations and policy making, which means that Governments are forced to introduce regulations for nascent technologies. Concerted actions by industry leaders, regulators and policy makers are needed in order to maximise the value of digitisation in aviation, travel and tourism. The problem with fake news on social media reflects the risk of not embracing the new digital trends and not addressing the related opportunities and challenges. A series of actions for all participants in the ecosystem can be identified. They include the following according to the study by the World Economic Forum cited above [29]:

- Empower educational institutions to design curricula that help to prepare the next generation for the digital economy.
- Support the transition of the workforce with reselling current employees through training.
- A framework of rules for the operation of machines and AI systems is needed. Yet frameworks should remain flexible enough to not kill the innovative spirit but help to foster the development with guidelines and pro-active measures to address liability, safety, security and privacy of these new technologies.

- Transforming legacy systems into agile platforms with interoperability, enabling plug-and-play interactions between the partners in the ecosystem.
- Define a regulatory framework that defines the appropriate use of data, involving private, public and civil-society organisations.

4.5.5 Global political trends and economic evolution

International departures have more than doubled between 1996 and 2016, from 650 million to 1.45 billion, according to the world bank [32]. It appears that growth will continue. According to the World Economic Forum report on digital transformation for aviation, travel and tourism [29] global emerging markets will account for 70% of forecast share of global airline travel by 2034. Demographic developments play a key role in terms of growth and how fast new technology will be adopted. Regions in Asia, Africa and Latin America will drive a main part of this growth due to a rising middle class. Technology adoption may be speedier in developed countries though. Businesses will also face the challenge to manage experiences for travellers who are less used to technology.

Growth means that the aviation stakeholders need to adapt faster. But it also creates other problems in terms of overtourism and sustainability. This is further increased by additional cruise tourism. A number of places have started to tackle too many visitors. The authorities of the Philippines and Thailand have introduced a forced break for Boracay Island (Philippines) and Maya Bay (Thailand). Cinque Terre in Italy try an app with which tourists can see the number of people on the routes in real time. Machu Picchu in Peru turns to time slots. Jeju Island in South Korea faced almost 180 daily flights in 2017 and 15 million visitors, yet relief came not through the authorities but due to a Chinese ban not related to the underlying problem. Colombia's Caño Cristales site faces the challenge of balancing a delicate ecosystem with an unprecedented number of visitors. In a quite exceptional approach for a developing country they tackled this fast and introduced a set number of rules: no plastic bottles, no sunscreen or insect repellent in the water, no swimming in certain areas, no cigarettes, no feeding the fish. On arrival, visitors attend a briefing to make this completely clear. They are also training local tour guides and hosts [33].

Political tendencies to protectionism rather than continued globalisation as well as rising fuel prices could potentially have an impact on the growth forecast [34].

Other key considerations about the future evolution include

- How can stakeholders in the aviation and travel eco system ensure data security and comply with new data protection laws while incentivising customers to share personal data in exchange for tangible benefits, such as a hyper-personalised travel experiences. To what degree can personal data be securely and ethically used, and made interoperable across public and private stakeholders, to boost safety and security?
- The world of the hyper connected consumer is moving from physical to digital assets. Examples such as Uber, Amazon, Google, Apple, Expedia, Tesla, WhatsApp and more illustrate that the enterprise value of the future is about how well an organisation develops their digital assets for the benefits of customers and employees [35]. Is there a model for aviation to foster global collaboration and facilitating the sharing of company assets, to unleash the full potential of digital transformation, while also preserving the individual

company's relevance in the battle for consumer mindshare? How will this impact on future investments in both physical infrastructure and digital technologies.

- How will the operating models of travel organisations change in a smart and connected world where the lines between online and offline are blurring, and physical assets turn to digital ones? How will this change the behaviour and expectations of individuals?
- Will it need completely new players in the market to finally push aviation and travel stakeholders towards more radical change? Similar as the low cost model gradually forced airlines and airports to change? Google now operates a large number of its own services, all branded accordingly, including Google Flights, Google Destinations and Google Hotels. Such improvements are already proving fruitful as more travellers turn to the Mountain View, California-based search company. According to the annual Portrait of American Travellers study from MMGY last year, 40% of travellers cite Google as their first source in booking trips. That's up 8 percentage points from the 2016 study [36].

5. Key conclusions

Aviation, particularly airlines' small profit margins and poor market capitalisation versus technology companies and other industries and increasing customer expectations are clear indicators that substantial change is needed to get fit for the twenty-first century. Airlines and airports have started the change process slowly, but a lot of digital transformation activities are ongoing in the meantime.

Main focus of activities is on customer experience improvements, cost efficiencies, better analytics and revenue optimisation as well as operational excellence. Internal and external innovation labs have been created to support the process, with more or less success so far. The most advanced companies have in-sourced or created at least some key parts of the software development activities.

Yet more drastic changes are still the exception, most of the activities are focused on creating workarounds based on decade old processes and systems. A lot of industry players either find it difficult to navigate in these stormy waters, or they prefer to stay ashore in the waters they know well and avoid any marks which indicate new ways because they cannot imagine that they will work.

It is critical for all board members and the whole leadership teams to have a deep understanding of the digital agenda, to ask the right questions and to drive the vision and the strategy. A big vision what the destination is and behaviour as prerequisites for branding and selling the trip to get the whole team work towards getting through stormy waters and test new ways to build the new world, even starting to build and show fast results are the main areas that still need to be completely fulfilled in many cases.

There are a lot of innovative start ups in the market, lots of opportunities to start drastic change. Disruptions and faster change will mean that the storm will get even stronger. Political changes and regulations, particularly with the increasing protectionist agenda of some countries are a risk for the foreseeable future in terms of expected growth.

Cost pressures above all due to increased labour and fuel cost but also in the area of aircraft cost are other main risks to be aware of. The latter could become bigger given the deals by Airbus with Bombardier and by Boeing with Embraer, which will restore the duopoly which the two giant manufacturers have had for many years. Both Bombardier with their C-series and Embraer with their E-series had started to compete directly with the smaller versions of Boeing and Airbus jets.

Technology will remain a key disruptor - but also a key enabler. If the big vision and behaviour start to get alive and are followed by branding and selling as well as building activities based on solution orientation, agile principles and the will to move forward and not remain in the past, then digitisation and current technological opportunities can open doors to do things previously thought impossible, creating seamless customer and staff experiences and creating endless new revenue and cost saving opportunities at the same time. Digitisation offers opportunities never seen before to shape the future. But industry leaders need to take up this chance and introduce the radical changes needed to create the potential value. Only the players who do this best will have a chance to survive and to compete successfully in the light of these dynamic technological changes and ever increasing customer demands. And competition is likely to increase strong players coming from originally other eco-systems such as Google, Amazon, Alibaba or others not seen before which will continue to move forward in the aviation and travel sphere.

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Conflict of interest

There is no conflict of interest to declare. Our strength is being an independent consultancy, which is very active in the digital transformation, innovation and start up travel and aviation arena.

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