FUTURE

OF THE AIRLINE INDUSTRY 2035

soif
School of International Futures

IATA

Foreword to 2018 edition

Dear Reader,

Thank you for joining us on this journey into the future. We hope you find the report a thought-provoking and insightful read into the factors which may shape the air transport industry in the years to come.

IATA's Industry Affairs Committee (IAC), a group of 20 airline heads of government affairs, commissioned this study with the aim of anticipating the key risks and opportunities global commercial aviation will face between now and 2035. The Committee had three specific goals in mind when commissioning this study:

- **Anticipate the opportunities and challenges the industry will face and take actions to address them today**. As arguably the most global of industries, the externalities international air transport faces are numerous. From geopolitics to technological innovation, demographic shifts to environmental concerns, the winds of change buffeting the industry can come from many directions. Understanding the potential landscape in which airlines find themselves is therefore critical to ensuring that aviation can grow sustainably in the future – and maximize its potential to deliver the economic and social benefits that greater connectivity brings.

- **Facilitate similar discussions at an airline and alliance level**. It is our hope that our airline members – and their alliances, as the case may be – will see value in this study and use it to reflect on how they will be affected by future developments. How will their specific regulatory and business environments be changed by the trends we've discussed here? How can alliances address the risks, and take advantage of the opportunities, that some of these trends may give rise to?
  Since its first release in 2017, several airlines have taken this study as a starting point for a strategic planning exercise, focusing on what the themes and implications mean for their specific business model. For example, Air France-KLM gathered senior representatives from various functions to explore how the company is prepared for the different scenarios outlined in the report, and identifying actions needed to enhance the group's ability to take advantage of the trends outlined.

- **Partner with governments to lay the groundwork for sustainable air connectivity growth**. By planning for changes that lie ahead using internationally accepted smarter regulation principles, governments can ensure that their economies and societies will reap the benefits of increased connectivity – and position aviation as a key contributor to the 2030 United Nations Sustainable Development Goals. The industry seeks to be a strategic partner in that journey, and we look forward to exchanging views with our colleagues in government on what the trends described herein mean for their specific countries and regions – and how best to address them.
  Over the past 12 months, IATA has hosted workshops with senior government officials in Australia, Brazil, the European Commission, France, New Zealand and Nigeria. The objective of these discussions was to delve into how the scenarios and themes in the report could impact connectivity in their jurisdictions. While local characteristics differ, several common elements came out from the discussions to date:

- A desire for regulators to understand better what is being done in other jurisdictions when it comes to infrastructure approaches

- A recognition that changes in the geopolitical landscape will create new opportunities, but also new challenges to maintain global approaches to aviation policymaking. How can global institutions accommodate new aviation powers while maintaining a consistent approach that has resulted in steady growth since the 1944 Chicago Convention?
- The evolution of consumer protection issues, looking specifically at multimodality, greater numbers of passengers with disabilities and new products.
- Creating a sufficient pipeline of pilots to meet demand
- Data will be undoubtedly be a key regulatory theme of the future. Regulators expressed a desire to understand better the data initiatives the industry is undertaking. Airlines recognized a need to better track regulatory developments on data in key jurisdictions, as these are often not initiated by transport ministries and departments.

In 2018 and 2019 we aim to continue our outreach with governments who are interested in exploring the opportunities and challenges aviation may face in their countries, as well as continuing our discussions with governments who have already identified actions needed to "future-proof" their aviation connectivity.

The report is not meant to be the start and end of the conversation. It is the beginning of an ongoing discussion on how to ensure that aviation continues to be in the business of freedom, now and in the future. With that in mind, do share with us your insights, thoughts and feedback at gia@iata.org.

Happy Reading.

Paul Steele

Senior Vice President

Member and External Relations

IATA

About IATA

The International Air Transport Association (IATA) is the trade association for the world's airlines, representing some 265 airlines or 83% of total air traffic. We support many areas of aviation activity and help formulate industry policy on critical aviation issues. IATA is led by Alexandre de Juniac, Director General & CEO since September 2016.

About SOIF

School of International Futures (SOIF) is an independent strategic foresight consultancy set up to enhance the capacity of business leaders, policy-makers, governments and international organizations to use and gain value from horizon scanning and foresight. We help organizations think differently – and more confidently – about the future.

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Executive Summary

What should airlines be thinking about, and what steps should they start taking today to be ready for the opportunities and challenges of the next 20 years?

This report sets out the findings of a study exploring the forces shaping the future of aviation, and looks at the potential implications for the airline industry.

It was commissioned by IATA's Industry Affairs Committee (IAC) carried out by School of International Futures (SOIF), and informed by exchanges with the airline industry and external experts.

New challenges are always on the horizon. It's hard to find an industry that hasn't at some point been knocked sideways by unexpected developments or changes in the rules. Change can be sudden and overwhelming, or gradual and unnoticed; in either case the result can be hard to manage – and sometimes fatal – for organizations not actively preparing for it.

Technology – as newspapers, the music industry and taxi companies have discovered – is a common source of disruption. But drivers of change can also be political and regulatory, social and economic – not forgetting environmental factors and policies designed to address them.

In more concrete terms, do you know who your customers will be in 2035? What routes will you fly? Will you determine the schedules, or will your customers, or your government, or the neural network of the IT services company that now owns you? Will you be a global environmental pariah, or will you be the industry that made a huge effort to clean up its act, at the same time creating jobs and helping pull millions out of poverty?

The good news is that, while the future is unpredictable, there are steps we can take to be better prepared for what it may bring. As an aviation community, armed with an analysis of future trends and acting with a common purpose you can take steps to influence how the future unfolds. And as a commercial player in the airline industry, you can add these insights to your strategic thinking to gain a competitive edge.

With this in mind, we started by exploring the question:

What are the key drivers of change that IATA and airlines should be thinking about to prepare for future opportunities and challenges over the next 20 years?

We cast a wide net to identify sources of change, drivers, trends and other weak signals that would impact the industry's future operating environment. We explored and prioritized these with the IAC and industry to develop alternative scenarios for the sector and surfaced a set of implications and recommendations, issues that IATA can start to engage with today.

An overview of the project is provided overleaf in Figure 1. The main steps were:

- Interviews and Horizon Scan (Section 2)
- Prioritization of drivers of change and theme development (Section 3)
- Scenario development (Section 4)
- Implications and recommendations (Section 5)

Our recommendations are collected together in Annex D. But the main purpose of the report is to get you to think about what these changes will mean for your business.

PROJECT OVERVIEW

01

HORIZON SCAN AND INTERVIEWS TO IDENTIFY DRIVERS OF CHANGE

A series of interviews was held with global trend specialists and experts in other fields, as well as aviation experts. Material from the interviews was taken together with a literature review and horizon scan to identify a list of 50 drivers of change (for information see *Section 2* for the full driver list see *Annex E*)

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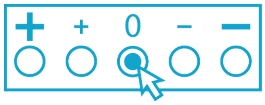


PRIORTIZATION OF DRIVERS OF CHANGE AND THEMES

An online assessment was conducted IATA Industry Affairs Committee and approximately 500 industry professionals* to gather industry views on the most important and uncertain drivers of change (see *Section 3*). Drivers were then grouped into 11 themes – important issues to explore during scenario development (for information see *Section 4).*

DRIVERS OF CHANGE

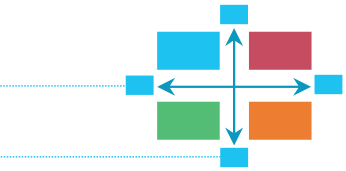
Shifting borders, boundaries and sovereignty
Infectious disease and pandemics
Defence priorities dominate civilian needs
Rising sea levels and reclaimed habitats
Alternative fuels and energy sources
Geopolitical instability
Trade protection and open borders
Resource nationalism
Water and food security
Global income inequality
Terrorism
Human-controlled weather
Urbanisation and the growth of megacities
Middle class growth in China and the Asia-Pacific region
Cybersecurity
Unionisation of labour and regional independence
Global population growth fuelled by Asia and Africa
Passenger identity and fraud
Global aging
Increasing influence of alternative regional and global institutions
Extreme weather
Bribery and corruption
Circular economy
Environmental activism
Strength and volatility of global economy
Rise of populist movements
Privatisation of infrastructure
Price of oil
Alternative modes of rapid transport
Robotics and automation
Open data and radical transparency
New aircraft designs
Expanding human potential
Concentration of wealth into a 'Barbell' economy
Shifting ethnic, political and religious identity
New modes of consumption
Government ownership of airspace and critical infrastructure
3D printing and new manufacturing techniques
Personal carbon quotas
Strength of governance
International regulation of emissions and noise pollution
Tensions between data privacy and surveillance
Internet(s) of Things
Virtual and augmented reality
Geospatial technology
Level of integration across supply chain
Disability, health and fitness
Changing nature of work and competition for talent
Anti-competitive decisions

THEMES

Geopolitics
Africa and Asia-Pacific
Security and Borders
Environment
Economy
Privacy and Trust
Values and Communities
Technology
Data
Government
Business models

*Solid lines represent drivers prioritised in the online exercise

03



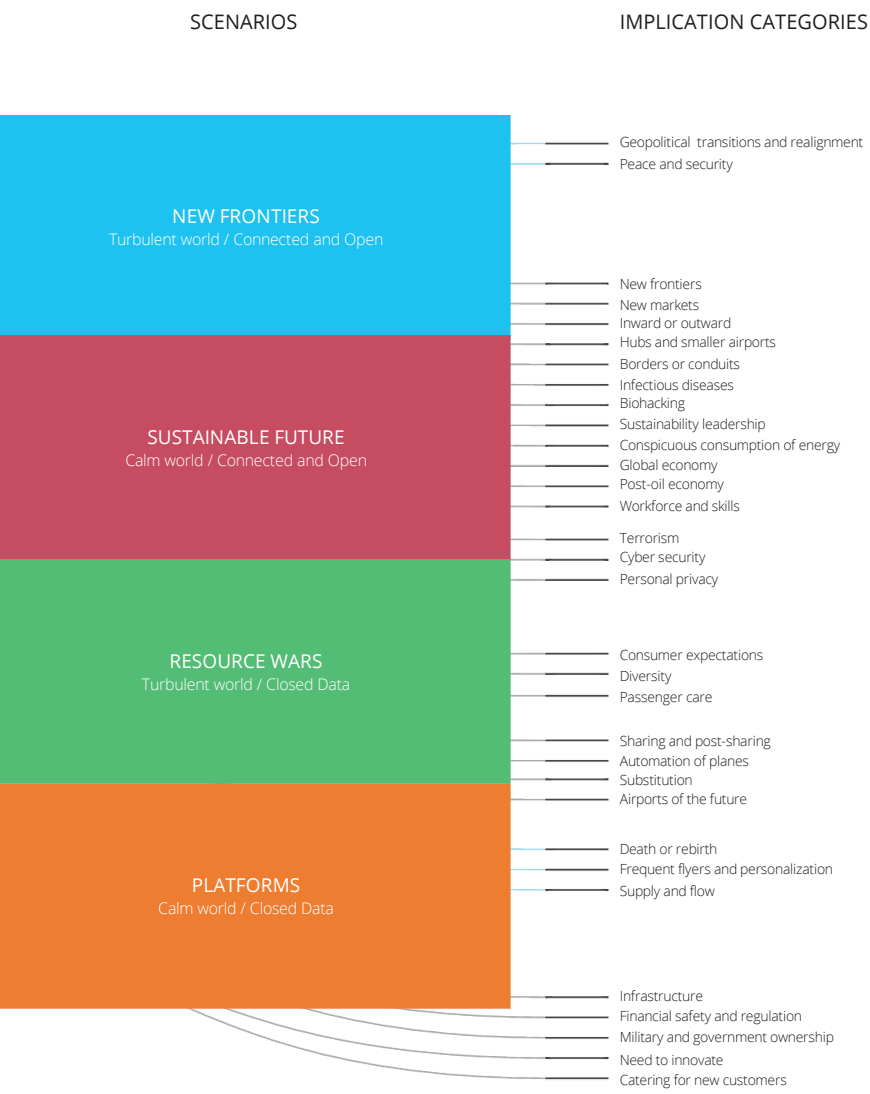
SCENARIO DEVELOPMENT

Four contrasting scenarios were developed for the industry out to 2035. See *Section 5* for how this was done, and the resulting scenario narratives.

04

IDENTIFICATION OF IMPLICATIONS AND RECOMMENDATIONS

A set of implications was generated from a wind-tunnelling exercise, additional exploration of the scenarios, and inputs from the horizon scan and interviews. A selection of recommendations are presented in *Section 6*, issues that are important for IATA and its members to engage with and steps that they can start taking now to prepare for change.



Recommendation 1
Geopolitics | Geopolitical Transitions and Alignments)
IATA should continue to support global standards bodies such as ICAO, and think strategically about how the relationship between IATA and these institutions will evolve. It will be important to maintain global standards for a global industry, especially in futures that are increasingly multipolar or where there are shifts in the balance of power (see page 29)

RECOMMENDATION 13:
Data | Death or rebirth
IATA should consider measures that support airline ownership of data (e.g. safeguarding privacy, commitment to common data protection procedures), and look to establish a global industry-wide position on data protection. A more open approach to data and interoperability at a global and industry level may be more positive for the industry and for consumers (see page 37)

RECOMMENDATION 19:
Technology | Airports of the Futures
IATA should build relationships with those responsible for urban planning (not just air infrastructure authorities) to ensure industry needs are linked into infrastructure planning, particularly when there are major plans for developments around airports (see page 41)

Figure 1: Infographic depicting the main stages of the project.

Section 1 – Introduction

Over the past 30 years the airline industry has seen a number of changes, such as the increased market share of low-cost carriers (LCCs) as well as facing its fair share of challenges, from volcanoes erupting to infectious disease outbreaks.

The next 30 years are likely to be more turbulent, as a new wave of technological change and innovation unfurls. Some see this wave sweeping the airline industry away, citing as precedents the taxi industry before Uber arrived, the music industry before internet downloads, and the printing industry before computer design software.1

And technology is not the only source of disruption. The UK's Brexit and the presidential election in the United States remind us that politics can always spring surprises. As a global industry, subject also to national-level regulation, the airline industry is highly sensitive to such surprises: will, for example, the UK continue to be party to existing European legislation governing airlines or will they need to renew agreements with European, US and other countries?

These twin forces of technology and (geo)politics featured heavily in the research we conducted for this study, and the consequences for the airline industry of the shifts and disruptions they could cause featured prominently in the material we gathered and the scenarios we produced. But they are not the only drivers of change that airlines need to look out for.

In this context, this study began by exploring the question:

What are the key drivers of change that IATA and airlines should be thinking about to prepare for future opportunities and challenges over the next 20 years?

The project was carried out in four phases:

1. **Interviews and horizon scan to identify drivers of change.** To prepare for change, it is often what is going on outside your industry that is the greatest source of surprise. A series of interviews was held with global trend specialists and experts in other fields, as well as aviation experts. Material from the interviews was taken together with a literature review and horizon scan to identify a list of 50 drivers of change (see Section 3).

2. **Prioritization of drivers of change and themes.** An online assessment was conducted to gather industry views on the most important and uncertain drivers of change identified in phase 1. Drivers were then grouped into 11 themes –important issues to explore during scenario development. (See Section 4)

3. **Scenario development.** Four contrasting scenarios were developed for the industry out to 2035. See Section 5 for how this was done, and the resulting scenario narratives.

4. **Identification of implications and recommendations.** In Section 6 we set out the implications of the potential changes that will affect the airline industry over the next 20 years, together with some of the steps that the industry can start taking now to be prepared for these changes.

Section 2 – Horizon scan and interviews to identify drivers of change

Through interviews with domain experts, desk research and workshops with over 50 senior airline representatives, we identified a shortlist of 50 drivers of change (see Figure 2) that would have an impact on the industry out to 2035.

An initial horizon scan was undertaken using a 'STEEP' framework (Society, Technology, Economics, Environment, Politics – see Figure 2). The intention was to cast the net wide to identify both relevant drivers and trends, as well as weak signals from a wide range of fields, including new technologies, lifestyles, threats and potential wild cards, that might impact the industry's external operating environment. We consulted over 200 sources including airline data sets and publications, global trends reports, academic publications, think tanks, surveys and polls, blogs and alternative literature.

In parallel, we conducted 16 interviews with industry representatives, sector experts and futurists. The interviews were conducted using an adaptation of the 'Seven questions' format developed by Royal Dutch Shell, to elicit views on factors influencing the future. Interviews were non-attributable to encourage openness from interviewees.

A list of interviewees is provided in Annex A.

The full set of drivers are available in Annex E (separate document).

Drivers of change

Society	Technology	Environment	Economy	Politics
• Terrorism	• Cybersecurity	• International regulation of emissions and noise pollution	• Global income inequality	• Bribery and corruption
• Urbanization and the growth of megacities	• Expanding human potential	• Resource nationalism	• Strength and volatility of global economy	• Geopolitical (in)stability
• Passenger identity and fraud	• Robotics and automation	• Personal carbon quotas	• Price of oil	• Government ownership of airspace and critical infrastructure
• Global aging	• 3D Printing and new manufacturing techniques	• Water and food security	• Level of integration along air industry supply chain	• Strength of governance
• Middle class growth in China and the Asia-Pacific region	• Virtual and augmented reality	• Environmental activism	• Shift to knowledge-based economy	• Anti-competitive decisions
• New modes of consumption	• Internet(s) of Things	• Extreme weather events	• Privatization of infrastructure	• Defense priorities dominate civilian needs
• Tensions between data privacy and surveillance	• Alternative fuels and energy sources	• Rising sea levels and reclaimed habitats	• Concentration of wealth into a "Barbell economy"	• Shifting borders, boundaries, and sovereignty
• Global population growth driven by Asia and Africa	• New aircraft designs	• Human-controlled weather	• Unionization of labor and regional independence	• Increasing influence of alternative regional and global institutions
• Shifting ethnic, political and religious identity	• Alternative modes of rapid transit	• Circular economy	• Open data and radical transparency	• Trade protection and open borders
• Disability, fitness and health	• Geospatial technology	• Infectious disease and pandemics	• Changing nature of work and competition for talent	• Rise of populist movements

Figure 2: 50 Drivers of Change for the Airline Industry

Section 3 - Prioritization of drivers of change and themes

Key drivers of change

An online assessment of the drivers of change was conducted to prioritize drivers. The assessment form was sent to the IATA Industry Affairs Committee and approximately 500 industry professionals around the world.

Participants assessed the importance and uncertainty of drivers to 2035, and in some cases proposed additional drivers.

During the online assessment exercise, respondents identified 13 drivers that (a) were likely to have a high impact on the sector out to 2035 and (b) where there was a high level of uncertainty as to what that impact would be. These drivers indicated 'critical uncertainties' that we would reflect in the scenario development.

Drivers assessed as having greater than average impact and uncertainty

- Alternative fuels and energy sources
- Cybersecurity
- Environmental activism
- Extreme weather events
- Geopolitical (in)stability
- Infectious disease and pandemics
- International regulation of emissions and noise pollution
- Level of Integration along air-industry supply chain
- New modes of consumption
- Price of oil
- Strength and volatility of the global economy
- Tensions between data privacy and surveillance
- Terrorism

A summary and exploration of these themes is set out in the following pages.

For the full set of drivers see Annex E.

Drivers of change assessed to have higher than average impact and uncertainty	
Alternative fuels and energy sources Alternative fuels and energy sources have the potential to disrupt the geopolitical balance of power, as well as to affect how businesses and the public consume energy. In aviation, energy sources such as bioenergy or fuel cells may replace traditional fuels, while advances in energy storage will favor the growth of renewables at a global level. How will the climate change and sustainability agendas affect government and public attitudes?	**Level of integration along air-industry supply chain** An integrated supply chain allows manufacturers to look into business processes across multiple suppliers and disparate platforms to follow materials, components and people wherever they are. The importance of emerging markets, economic growth and the appetite of developing countries for natural resources may boost global prices and make it trickier to configure supply chain assets. What will the supply chain look like and will it handle increasing complexity and demand volatility?
Cybersecurity The threat of cybersecurity is growing, becoming an industry in itself and a major concern in the daily lives of people and businesses using technology. In the future, increased connectivity between real-world devices including planes, cars and robots will blur the boundaries between virtual and physical security. As skills and knowledge increase, will cybercrime become the tool of activists, governments and companies, or a disruptive hobby?	**New modes of consumption** Consumers throughout the world have been seeking greater value from products and services, redefining their relationship with 'things.' The concept of access over ownership has changed as sharing models grow and thrive. We have already started to see a backlash against one-size fits all technology, increased demands for authenticity and personalized experiences, sustainable consumption and desire for face-to-face interaction. How will big data, transparency and predictive analytics influence marketing and branding?
Environmental activism Environmental activism may come from many directions, the public, the workforce, or even shareholders and governments. Generational and societal shifts may lead to new tools – younger people are more likely to participate in online activism than older generations – while technology and cyber activism provide new opportunities and threats. In the future, might activists take a more militant stance through provocative marketing strategies?	**Price of oil** After remaining unusually stable in the three years prior, crude oil prices fell precipitously in 2014 and the future outlook is uncertain. Will supply outstrip demand in the future? How will geopolitics, conflict and cartel behavior shape prices over the next 20 years? Persistent low prices may drive initial cost savings for transportation, but what are the global economic impacts.
Extreme weather events Extreme weather events (whether wildfires, droughts, extreme temperature, storms or snowfall) are expected to increase in both frequency and severity, driven by climate change. How will governments, municipalities and the industry mitigate and adapt? Will we be able to predict, or outrun extreme weather? Might extreme weather events damage infrastructure and disrupt communities with increasing frequency?	**Strength and volatility of global economy** Instability and turbulence in financial markets has characterized much of the 21st century and may continue. Economic shifts from West to East and an increase in South-South trade are likely to have a significant impact on international politics and governance, as well as other trends such as increasing inequality. As the economic influence of developing nations increases, new markets, competitors and demands will alter patterns of trade, changing what goods are transported where.

Table 1: Drivers of change with greater than average impact and uncertainty

Drivers of change assessed to have higher than average impact and uncertainty	
Geopolitical (in)stability Interstate warfare and violent deaths have declined since the 1950s, but one in four people on the planet now live in fragile and conflict-affected areas. Increasingly, actors in these conflicts are not clearly defined, but include individual acts of violence and terrorism, terrorist groups, warlords, mercenaries, militias and cartels. Over the next 20 years, state fragility, religious and ethnic tensions, and mounting pressure on global resources may sow the seeds of conflict. Will these be fought on the ground, in cyberspace, or new arenas? Meanwhile, will stable parts of the globe be destabilized by growing populism, and will nationalist movements spill over onto the international stage?	**Tensions between data privacy and surveillance** Advances in connectivity and sensor networks are likely to empower citizens by providing real-time accountability and transparency. At the same time, privacy and surveillance are likely to be high on the list of military and government concerns over the next two decades. How much privacy will people be willing to give up in return for convenience, economic benefit and security? For corporations, data breaches and cybercrime may require new measures to protect data; privacy itself could become a valuable commodity.
Infectious disease and pandemics In the 1960s many infectious diseases were thought to be under control, but the emergence of new threats such as HIV, SARS, Zika virus as well as animal diseases such as BSE have reacquainted the world with the risks. Will future outbreaks limit people's desire and freedom to travel, as well as presenting significant economic challenges for the industry? How might new technologies, for instance synthetic biology, help detect and cure disease? Might the next pandemic be of human design?	**Terrorism** Terrorists have shown the ability to adapt to the techniques and methods of counter-terror agencies and intelligence organizations. Will democratization of technology drive further shifts from (currently more common) state-supported political terrorism towards diverse, free-wheeling, transnational networks? States with poor governance; ethnic, cultural, or religious tensions; weak economies; and porous borders have been breeding grounds for terrorism – but where will tomorrow's threats come from, and will they be virtual or physical?
International regulation of emissions and noise pollution The airline industry contribution to overall CO2 emissions is relatively low compared to other transport sectors, although forecasts to 2050 vary in optimism. Will standards such as the ICAO CO2 emissions standard (along with technology, operational and infrastructure improvements) be sufficient to meet international ambitions? What role will politics and public perceptions play in the future? And will the media be a friend or a foe? Could air travel become conspicuous in a more sustainable world?	

Theme development

We identified 13 key drivers that display both high impact and high uncertainty. At the same time, we took account of drivers that have a more predictable trajectory, as well as those where there was less consensus on the level of impact or uncertainty among respondents. A lack of consensus can help to identify 'weak signals' of change not yet on most people's radar (see Annex B for more information).

Among the high impact drivers identified during the survey were middle class growth in Asia-Pacific, geopolitics, financial stability, and oil price. New technologies and aircraft designs were also in this group.

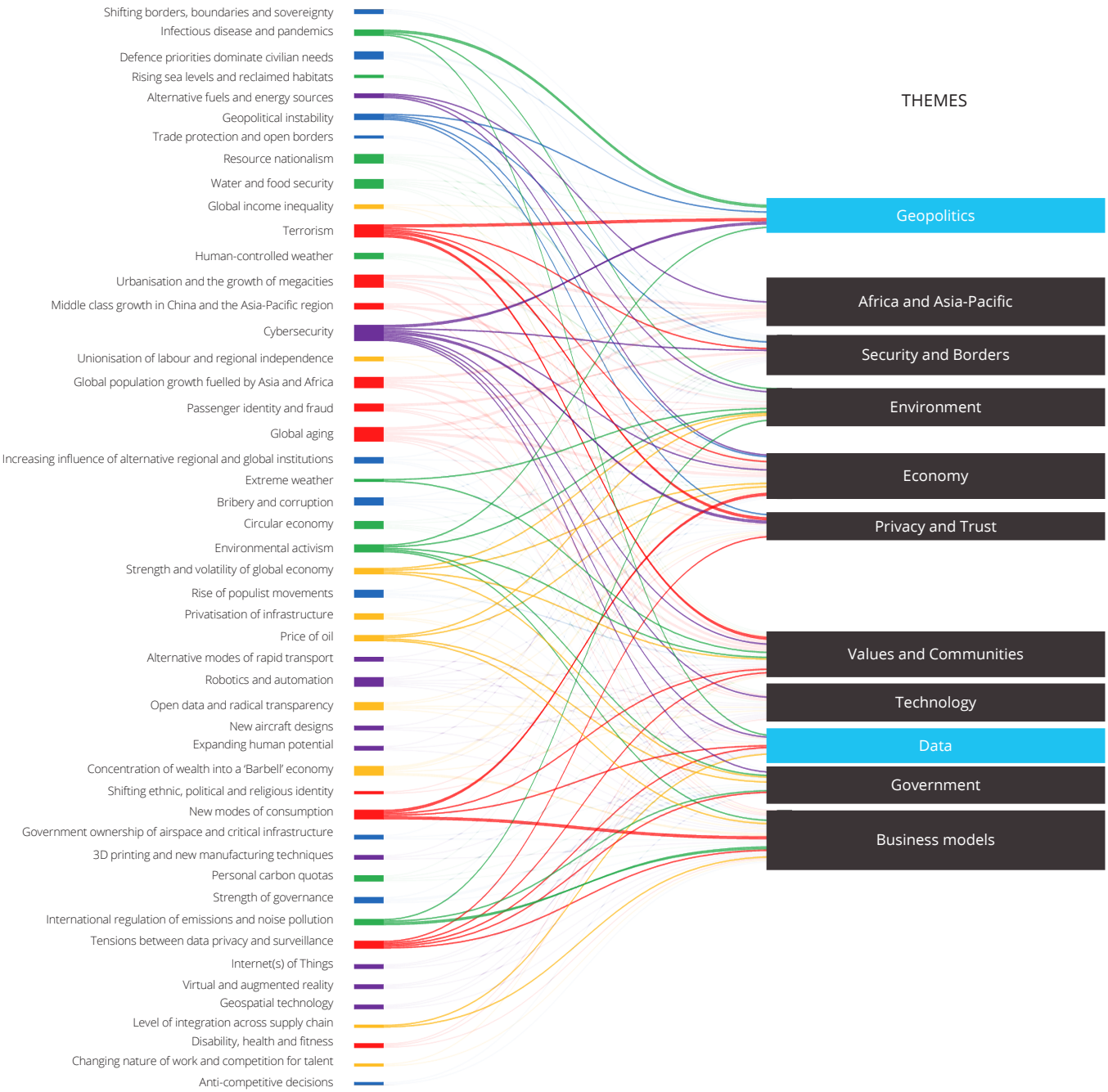
The drivers of change judged to have high uncertainty, however, tended to be political, economic and environmental rather than social and technological, although technologies such as Internet of Things and alternative modes of transport were deemed to have highly uncertain outcomes in 2035. For additional information see Annex B.

To bring in the potential impacts of some of the 50 drivers that were outside the 'top 13' a workshop was conducted with industry representatives in March 2016 to explore the drivers more deeply, consider interactions between them and start to imagine scenarios airlines might face in 2035.

As a result, we came up with the following 11 themes, some of which refer to more than one driver of change (for example, the Environment theme includes drivers of change Extreme weather and Environmental activism – see mapping in Figure 3).

Themes

- Geopolitics
- Data
- Africa and Asia-Pacific
- Government
- Security and borders
- Privacy and trust
- Business models
- Economy
- Values and communities
- Environment
- Technology



*Solid lines represent drivers prioritised in the online exercise

Figure 3: Extract from Figure 1 showing the map of drivers to themes

The key elements included in the themes are as follows:

GEOPOLITICS

This set of drivers explores aspects of geopolitics, including the role of international institutions and governance, the degree of peace or conflict in society, and level of international cooperation, openness and trade. Consideration is given to relationships between the US and China and other regions as well as the role of corporations and non-governmental actors. Instability may have many sources: tensions in the Middle East, protectionism in a world of scarcity, or flashpoints around the world. Other factors include transitions from democracy to authoritarianism, levels of international cooperation and state-level interventions (or inertia). How will power shifts from West to East disturb the status quo?

DATA

This theme explores the impact of big data on businesses, government and the public, looking at how the ever-growing availability of data changes the nature of society. At one extreme we may see a connected world, with open access to information and harmonized standards. At the other, asymmetries between those who own or control data and other actors in society. Advances in big data, predictive analytics, sensor technology, processing power, connectivity and storage pose significant challenges as well as offering opportunities for businesses and consumers. Improvements in data and analytics are expected to help airlines predict and adapt to changes in supply and demand in real-time.

AFRICA AND ASIA-PACIFIC

Trends in population growth, global aging and middle class growth in Africa and Asia-Pacific are expected to have a large impact on the airline industry, influencing not only where people live but how they live. More travelers are expected from non-traditional markets where middle classes are growing. What new demands will this place on airlines and airports? What value will the younger generation place on cost and convenience, and on time? Although the potential of this new demographic is recognized, uncertainty remains about how well the industry will meet the needs of passengers as the consumer base diversifies. And will this new mobility lead increase the spread of infectious diseases, particularly in the context of increased urbanization?

GOVERNMENT

The origins and development of the airline industry have been heavily influenced by governments, whether through regulation, investment in infrastructure, or support for flagship carriers. This relationship is likely to continue, despite the potential for a greater role for private actors in aviation, but how will the relationship between government and the industry evolve? How will advances in technology and data be utilized and regulated, and how will the military and civilian uses of aviation be managed?

The removal of restrictions on foreign ownership, cross-border consolidation and freedom of travel could be important issues for the success of the industry. In the future, to what extent will nations choose protectionism over free markets?

SECURITY AND BORDERS

Key questions include open skies and airspace management, border restrictions and migration, and the role of the military. Terrorism and cybersecurity will also influence the openness of borders. Concerns include future consequences for security and safety within the industry, and the impact on insurers. Will the industry keep pace with (or anticipate) new and emerging forms of terrorism driven by the democratization and pace of technology?

PRIVACY AND TRUST

The combination of trends in big data, automation and the internet of things is expected to lead to new opportunities, transforming how people and devices are monitored and marketed to in real-time, as well as threats including increased potential for cyber-terrorism and espionage. To realize the opportunities, tensions between data privacy and surveillance requirements will need to be addressed as people redefine their relationship with companies, governments and each other. The trend towards open data and radical transparency on one hand (to drive innovation or as demanded by consumers) may cause tensions, for example when companies want to protect secrets to maintain a competitive edge.

BUSINESS MODELS

Will airlines remain autonomous businesses, integrate with other firms, or become commodity suppliers? Where will future revenue come from e.g. how will non-aeronautical revenues be shared between airports and airlines? Might sharing economy business models or new technologies facilitating alternative (international) point-to-point travel disrupt the industry? In the future, will flying be a destination ('air cruises', slow travel, social travel)? How will technology affect existing supply chains and the life-cycle of aircraft? What is the future role of cargo, and what are the new frontiers of travel?

ECONOMY

The strength or otherwise of the global economy is a key theme. Continued crises and volatility in economic growth will have direct impacts on fuel costs and the availability of funding and investment. Will economies of the future be oil-dependent? (The price of oil was voted as the driver with the highest impact and uncertainty.) Innovation and adoption of alternative fuels by the aviation industry could be limited over the twenty-year time frame, especially if a low oil price translates into little incentive to innovate; on the other hand, instability in oil producing countries may (by increasing the price of oil) result in greater innovation. Disruption may also come from new technology, e.g. a breakthrough in nuclear.

VALUES AND COMMUNITIES

As new generations, e.g. millennials, enter the scene (and the population ages) and the aviation customer base diversifies, how will attitudes change? Will we see intergenerational divides? Or more social travel? And what demands will diversity and an aging population place on the industry? Issues include mobility and health, entertainment and connectivity, dietary requirements, language. Will new travelers be more budget conscious; will they demand higher sustainability or transparency in their interactions with corporations? How should the industry engage in debate and discussion on these issues?

ENVIRONMENT

Recognition of the impact of mankind on climate change grows every year, and there is growing awareness and concern beyond CO2 emission levels. With increased pressure on water, food and resources, how will attitudes and regulation change? How should airlines engage with this issue in the short, medium and long term? What alternative modes of energy or new technologies are relevant to aviation?

TECHNOLOGY

The airline industry appears to react to new technology rather than lead the way. Disruption to existing airline models may come from energy breakthroughs, alternative modes of transport, big data and data transparency, new manufacturing tools, and quantum computing. At the same time, some technologies may limit the need to travel. There are concerns that the industry is locked in the current paradigm and blind to the impact of disruptive factors. Over short to medium distances, how will new modes of rapid transport (e.g. hyperloop) influence the way people and goods travel? And is it inevitable that long-distance travel will remain an airline monopoly?

Section 4 – Scenario Development

An exercise was conducted with industry representatives in March 2016 to start to explore the themes set out in Section 3 and to imagine possible worlds that the industry may face in 2035.

Four alternative scenarios were developed for the airline industry in 2035, building on workshop outputs.

A 'two axes' approach was used that is particularly suited to generating scenarios that are accessible and compelling. Each axis represents a critical uncertainty for the industry, a high impact, high uncertainty theme.

The two axes chosen (high impact, high uncertainty issues) were Geopolitics and Data. These uncertainties were used to generate four distinct and contrasting scenario spaces from a range of possible futures in which outcomes associated with each of the additional 9 themes were explored. We considered how each theme might develop by 2035, based on how the drivers of change influencing these themes could interact to shape the future.

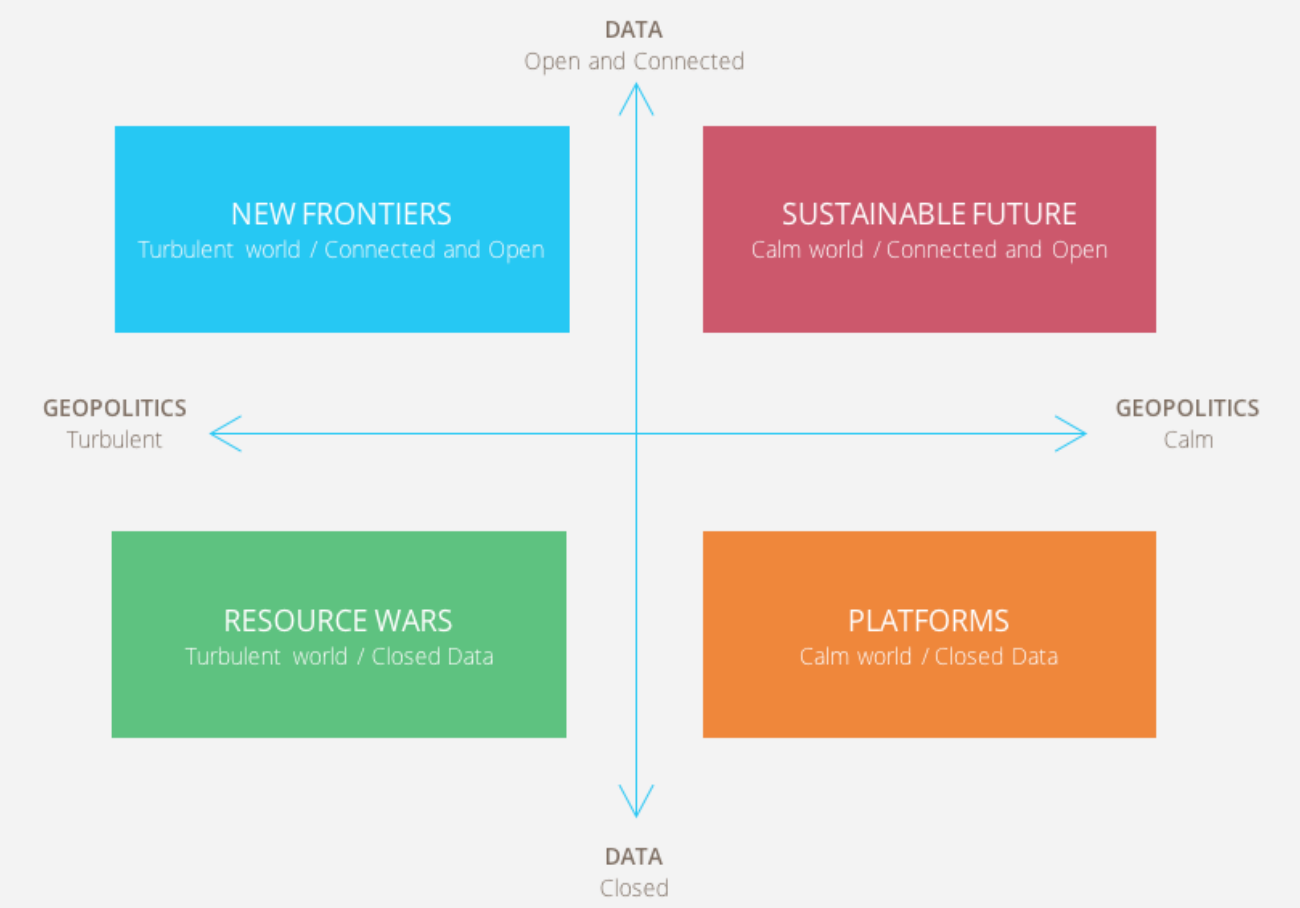
CRITICAL UNCERTAINTIES (AXES)

Geopolitics (Turbulent --- Calm) This axis includes aspects of geo-politics, future levels of terrorism, cyber warfare and security, trade, open or closed borders and the strength of governance.

Data (Open and connected --- Closed) This axis takes into account the impact of developments in the generation and use of data. At one extreme, a connected world, with open access to information and harmonized standards. At the other, asymmetries between those who own or control data and those who just generate it, whether governments, businesses or the rest of society.

SCENARIOS

A summary of the scenarios is overleaf and individual scenarios are presented over the next 12 pages with a table summarizing the main themes and characteristics. Please see Annex C for a comparison table of the themes across the four scenarios.



New frontiers

A world which has seen a shift of power to the East associated with the creation of alternative institutions. Competition for economic and military power has shifted to new frontiers, including space. China has become a champion of sustainability. Access to information is open and democratized, empowering people, companies and organizations. However, cybercrime, state surveillance and other challenges persist.

Resource wars

A turbulent world in which an aggressive, nationalistic China threatens a US distracted by continued conflict. The Middle East and Asia have seen a wave of territorial disputes and land grabs, and the world has realigned into resource trading blocs. Inequalities between resource rich and poor regions have limited movements between regions. Data asymmetries exist between countries, and governments increasingly use data to monitor and control their citizens.

Sustainable Future

A peaceful, multipolar world in which strong international governance has allowed infrastructure decisions to be prioritized. Open access to information and advances in big data, predictive analytics and artificial intelligence (AI) have had a positive impact on society. Rapid innovation helps people meet sustainability targets, while new trade routes have opened up within and between the Global South and Asia-Pacific.

Platforms

A peaceful world in which China and the US have cooperated to open up international trade. Corporations play an increasing role in the economy, and a dominant elite controls data and data platforms. Africa has failed to enter the global stage with a collapse in commodity prices. In many countries, a disempowered public is increasingly dissatisfied with the political elite.

Figure 4: Scenario Framework

Scenario 1: New Frontiers

(Turbulent World / Connected and Open Data)

The world is fractious, with global governance increasingly dominated by competing Western and Asian institutions. The US and China are dominant on account of their economic and military weight, but the world has become more multipolar, with strong regional alliances around strategic interests. Europe has played a stabilizing role; its diplomatic initiatives are highly valued, and its companies have been at the origin of many of the technological breakthroughs of the past 25 years.

In the late 2010s China used its "Belt and Road" foreign policy to consolidate leadership of the Asia-Pacific region, seeking support from Japan, Indonesia, Vietnam, India, Kazakhstan and Australia. Initially re-basing its economy away from the dollar, a new Yen-Rouble-Renminbi standard was created competing with the dollar as the dominant reserve currency. The Asian Infrastructure Investment Bank (AIIB) continued to provide a platform for developing countries to access Chinese investment (as well as knowledge and R&D) in return for water and resources.

A turning point was the People's Republic of China's move away from censorship, tearing down the great firewall in 2019 to allow full access for citizens. This drove open innovation, reinvigorating the economy. For the first time the global community had full transparency on China's demographic, economic and social situation. In line with a global push towards sustainability, China introduced legislation forcing companies to invest in clean renewable energy and recycling.

A new wave of Chinese entrepreneurs took note of Silicon Valley's grand challenge mentality and used a similar approach to address societal issues.

The Western world has been slower to adapt, hampered by complex bureaucracies and inflexible trade agreements.

Conflicts still break out regularly in Africa, where organizations compete for resources.

Oil continues to dominate energy though most countries will be getting more than 80% of their energy from renewables and nuclear by 2050. Supply routes for oil and water have been the principal causes of recent conflict. China and the US have fought over strategic dominance of the Arctic as China seeks to reduce its reliance on shipping via the Strait of Malacca. Meanwhile China's strategic partnerships with Iran have helped establish the latter as a regional power.

The race to space in the late 2010s continued with Japan, US and China establishing moon bases from which to protect their assets – surveillance systems and geo-engineering platforms. Large-scale structures are now manufactured in space and lowered into earth orbit. National security priorities trump consumer interests – for instance, the global powers took an aggressive stance towards consumer microsatellites, requiring mandatory registration and shooting down any that strayed too close to military assets.

Oceans and sea-beds have also become military-controlled assets – with countries competing for control of lucrative mineral deposits.

Most other sectors, including energy, transportation and communications have been deregulated to encourage innovation.

People have increasingly 'shifted to passive' – in the 2020s this was exemplified by the shift from smart cars to semi-autonomous cars to full automation, with people finally letting go of safety concerns.

Today, this philosophy is part of our lives, pervading health provision with automated health scans and bio-screening in our showers, and revolutionizing personal finances –no need to file a tax return or worry about missing a payment deadline any more. Governments have almost total visibility of financial flows –citizens having given up control in return for convenience, economic support and security. In many countries, mega-cities – the economic and resource powerhouses – have taken on the role of the state, offering shelter to climate and political refugees – including those displaced by rising sea levels.

For businesses, 3-D manufacturing, scanning and design software have eliminated traditional supply chains, with goods increasingly produced and recycled close to the point of consumption. Most houses now have home-pharmacies, with remote doctors sending prescriptions direct. For businesses, it's been a struggle to protect innovative designs and IP. The creation of a centralized 3D-IP platform has helped minimize theft, though open-source replicas are increasingly available for most goods. The ability to print one-of-a-kind and short runs of objects has reduced retail costs while driving demand for customized products.

In healthcare and manufacturing, 3D-scanning and printing technologies mean custom heart valves and prostheses, and replacement parts for machines can be made to specification, reducing the need to stockpile spare parts. The 3D printing of organs has revolutionized healthcare.

Customer service has had to innovate to meet the needs of an increasingly demanding public with short attention spans. Successful companies have mastered the art of prediction, resolving or offering solutions before consumers realize problems exist. Artificial Intelligence dominates front-line service, but people still value the personal touch, such as the opportunity to meet real people in virtual reality spaces. Humarithms[1] – algorithms with a human touch – are the holy grail.

Sharing economy companies are increasingly responsible for vetting both their employees and users, following a wave of law suits.

The world is increasingly multicultural but the rapid growth of middle classes around the world has put pressure on overcrowded infrastructure. New technologies and data have helped improve the running of major cities, and while severe gridlock is unusual it's still a challenge to keep transportation moving

Healthcare has struggled to keep pace with a rapidly aging population and a proliferation of non-communicable diseases. More and more people are traveling with robo-healthcare assistants and exoskeletons. Rich nations with access to skills, labor and advanced engineering increasingly take advantage of personalized medicine and 'precision lifestyles'; surgery today is often performed by specialists around the world in health-hubs – robotic advanced treatment units. Great if there's one near you, but some countries failed to invest in the necessary infrastructure or made the wrong technology choices.

Policy changes in advanced economies encourage aging workers to stay in the workforce longer, while making it easier for women and part-time workers to stay employed.

Global instability makes people nervous travelers – especially given recent bio-bombs targeting specific genotypes and the growing trend towards 'homemade' security threats. We have also seen an increase in transnational crime as virtual communities of interest coordinate cyber-attacks across borders.

People are willing to pay more for low-risk flights. And airlines are keen to reduce risks too – every individual now has a risk rating, those who agree to be 'bio-chipped' and regularly monitored can travel more freely and AAA+ travelers get prioritized access. Since 2032 everyone in Europe has been chipped at birth.

[1] Gerd Leonhard: http://www.futuristgerd.com/category/humarithms

Theme	Description
Geopolitics	Rise of alternative institutions as shift of power to East and as challenge to US. China becomes a champion for sustainability, sharing expertise and helping developing countries improve their infrastructure in return for influence. Space, the Arctic and the oceans are the new conflict zones.
Data	General shift towards democratization of data, empowering people, companies and organizations. Increased risks of transnational cybercrime. Police state/ surveillance. New technologies and data help to reduce gridlock and address challenges in major cities.
Africa and Asia-Pacific	China prioritizes relationships within Asia-Pacific, offering investment in return for resources. Iran comes back into the fold as a regional power in the Middle East.
Government	Data-driven government and political experimentation. In most countries people give up control of data in return for convenience – a new 'social contract' based on data.
Security and borders	New forms of terrorism with greater access and 'homemade' security threats. Increased restrictions on movement across borders except for 'biometric' citizens. Military needs take precedence over civilian needs.
Privacy and trust	People increasingly 'shift to passive', giving up control of data in return for convenience, economic benefits and security. Virtual and physical boundaries blur. States increasingly sense and control all aspects of society.
Business models	Elimination of traditional supply chains. Shipping of materials rather than finished products, with production at or near the point of use. Businesses focus on customer service.
Economy	Series of financial crises and austerity. Cities are the unit of power. Oil prices are high. Policy changes in advanced economies encourage older workers to stay in the workforce longer, while making it easier for women and part-time workers to stay employed.
Values and Communities	Strong national cohesion and increased multiculturalism. Growing population with more people traveling (and demanding to travel). New challenges and stresses on healthcare and infrastructure.
Environment	Large numbers of displaced communities due to sea-level increases. Oil continues to dominate the energy mix – though many countries are on course to be more than 80% reliant on renewables and nuclear by 2050.
Technology	Sharing economy models are dominant; 3D printing has disrupted manufacturing.

Scenario 2: Sustainable future

(Calm World / Connected and Open Data)

The world has gone thirty years without a major international conflict, though borders have been redrawn as countries trade land and resources on a permanent or long-term basis.

Relative economic stability has allowed governments to take advantage of new technologies, while cooperating internationally to deliver on the 2015 Sustainable Development Goals (SDG) and COP21 agendas. Global warming has been limited and we're on track to meet the 2 degrees target. We've come a long way towards addressing the challenges of poverty, inequality and education.

In the 2020s there was concern that the G27 was on track to become the G200. Following the Chinese debt crisis, the G20 expanded to include the next biggest economies, Egypt, Iran, Nigeria, Pakistan and South Korea, and to consolidate economic policies around new sources of growth. A new rules-based system, based on the Global Governance Guidelines helped unlock political stalemate by abolishing veto rights and establishing an independent Committee for the Global Future, with a mandate to address environmental and social market failures.

At a regional level, multi-national corporations (MNCs) and international non-governmental organizations (INGOs) have focused investment strategies on Asia and Africa, playing an important role in delivering public services for countries, while slowly accruing political and economic influence.

There were two drivers of this change. First, the rise of citizen movements in the early part of the century, connected globally through the internet and social media, challenged governments and the global institutions on the effectiveness of their policies.

Second, MNCs, NGOs and networks for citizens have been quicker to respond to the disruption caused by global flows of people, information and data than territorial states.

These pressures were particularly acute in Africa and certain parts of the Asia-Pacific, which faced a perfect storm of climate change, food shortages and a rapidly growing population – rapid innovation was needed to meet challenges around water, environment and education.

Governments in these regions had seen it as their role to lead their populations on the path to economic growth and prosperity. But the big industrial visions they came up with didn't make sense to a restless, educated generation. Instead many people found alternative routes to realize their ambitions, gaining experience abroad in new economy hubs and campaigning NGOs, then coming back to change their countries.

Gradually governments realized that effective change could not be achieved without communities and businesses being empowered –encouraging emergent communities and business to participate in policy creation – preferring to nudge, sense and monitor their public.

Today in 2035, the lot of the global citizen has on the whole improved. The world is richer, and per capita income is higher. Life expectancy has increased worldwide, and economic indicators are positive. Some regions have benefited more than others but inequalities within and between regions are lower than 25 years ago.

International trade and investment is increasingly dominated by the global South and Asia-Pacific.

Open data played a crucial role in enabling this transition. With rapid global population growth (reaching 9bn in 2035) and many countries in India and Africa experiencing greater than 80 per cent urbanization, governments' primary objective was to address challenges around energy, food and poverty.

They took advantage of new opportunities to unlock existing assets, both financial and natural – by optimizing public service delivery, connecting users and suppliers, and opening up data (or selling it to the highest bidder).

Communities and companies rushed to take up the challenge, as governments privatized and deregulated industries including transportation, communications and energy. Governments took advantage of the global drive to open up data to harmonize and build a shared digital infrastructure around global platforms – vital for combating cyber-crime.

However, some governments became over-reliant on the sharing-economy, basing infrastructure and urban-planning decisions around companies who then held them to now re-nationalized key infrastructure assets, others are developing rival apps and businesses.

Increasingly suppliers are held accountable, and contracts remunerated based on asset performance over time, for instance, through the real-time monitoring of performance of manufacturing parts.

Jobs are part-time and expertise outsourced: advanced algorithms match skills to jobs – freeing people to work where and when they want –though benefits and remuneration are more complicated, with many companies treating workers as they do their physical assets, monitoring their performance, health and emotional wellbeing both during and outside of work.

Robotics and automation have also transformed the nature of work. Robots increasingly work alongside people, taking on physical and repetitive tasks, with humans adding value in the spaces where AIs have not yet become dominant.

But most expertise still lies in the corporations – who compete for access to talent and skills.

Blockchain and its derivatives have had a positive impact, democratizing access to financial and legal support, reducing friction in the economy and bypassing traditional financial organizations.

Digitization and big data analytics improve regulators' ability to track performance and outcomes, enabling them to shift from a concentration on process to the achievement of specific goals, including sustainability targets. This allows those regulated to modify and adapt their approaches without falling on the wrong side of the law, while giving regulators a clear view of the ultimate outcomes.

Recently companies have started paying people for access to their data – offering bonuses for exclusivity.

Traditional forms of trust are increasingly transient, with organizations required to publish data on all aspects of performance from staff mental health to energy trades.

Communities are increasingly empowered to influence politics and development. These communities transcend traditional geographies, often driven by the diaspora communities established by the Climate Resettlement Initiative.

Today people prefer point-to-point travel, although high-speed rapid transit through networks of hyperloops is still more affordable than many 'personal drone' clubs.

Air travel still dominates the international transportation of goods and people, but a lack of investment in alternative energy and storage has made it increasingly conspicuous in an energy-constrained world. Air travel is affordable but as a result of the Climate Resettlement Initiative some countries have started to introduce visas and travel restrictions for their nationals to help meet sustainability targets.

More people in Africa and Asia are traveling for the first time – leading to increased pressures on infrastructures.

Theme	Description
Geopolitics	Thirty years of peace, although borders have been redrawn. A more multipolar in which Egypt, Iran, Nigeria, Pakistan and South Korea join the G20 in the wake of a Chinese Debt crisis. Strong international governance enables long-term and cooperative infrastructure decisions.
Data	Open access to information, with shared platforms. Big data, predictive analytics and Artificial Intelligence (AI) enable rapid forecasting of intentions and behavior. People are paid for their data. Supervision and surveillance at work. Drive to harmonize international standards. Entrepreneurship and non-traditional careers.
Africa and Asia-Pacific	Africa and Asia-Pacific experience rapid growth, using new technologies to address key challenges around water, environment and education.
Government	Governments leverage opportunities associated with open data and open democracy. Authorities oversee implementation of solutions at a local level, but deliver through outsourced provision to companies and communities.
Security and borders	Open skies and borders with increased demand for travel from Asia-Pacific and Africa. New visas and travel restrictions limit travel as part of the Climate Resettlement Initiative.
Privacy and trust	Trust is transient with organizations required to publish data on all aspects of performance from staff mental health to energy trades.
Business models	Business and governments are data-driven. Holding and sharing more and more data, combined with predictive analytics and AI to forecast customer behavior. Grand challenges have evolved into precision challenges.
Economy	Calm world and a stable economy allows increased trade – new trade routes between South-South and East. Blockchain and other new technologies have reformed financial and legal sector, reducing friction in economy and bypassing traditional banks.
Values and Communities	Communities are empowered to influence politics and development. These communities increasingly transcend traditional geographies, driven by the diaspora communities established by the Climate Resettlement Initiative.
Environment	Rapid innovation helps people meet sustainability targets. Global approach to addressing climate change combining new technologies with new data platforms to solve societal challenges and combat cyber-crime.
Technology	People and goods increasingly move point-to-point over short distances using drones. Blockchain technologies have reformed access to finance and legal support. Real-time monitoring of physical and human performance.

Scenario 3: Platforms

(Calm World / Closed Data)

The world is fractious, with global The world enjoys a good degree of order, having addressed the structural issues of the early 2000s – the economic dominance of the financial sector and companies prioritizing next quarter's profits over longer-term growth. But tensions persist in many places.

The US and China are the superpowers, dominating the global governance landscape.

China successfully avoided the middle income gap many thought would destabilize its economy in the late 2020s. Today it is the top world trade hub, with Latin America, India and the Middle East also increasing in influence. This success is down to three factors: leveraging new manufacturing technologies to stay competitive with low-income economies; driving through legislation to promote public and private sector investment in high-value industries – aviation, power and telecoms; and new trade agreements to facilitate the global expansion of now partially-privatized Chinese State Owned Enterprises (SOEs).

The US meanwhile has maintained its military superiority by investing heavily in new technology, cybersecurity and surveillance, but also helped by the fact that China turned out to be more interested in economic and trade supremacy within a stable world system than in projecting military power.

In this G2 world, corporations are increasingly influential in national and local politics. With many companies in the Global Stock Exchange 10 (GSE10) having cash reserves exceeding national GDP, they play an important role financing infrastructure and development, in return for soft diplomacy and influence.

Post-oil, energy and data are the main currencies. While many countries suffered from the collapse in commodity prices, many Middle Eastern economies successfully diversified – investing to raise productivity and privatizing health systems and infrastructure such as transportation.

Alaska and Canada took a different path, capitalizing on their real estate to install massive pink farms (low-energy, high-efficiency vertical farms) and desalination plants powered by vast arrays of renewable energy, providing cheap food and freshwater that they sell around the world.

Other oil-based economies were less forward-looking: the collapse of commodity prices in 2030 hit many African and Latin American countries hard. Countries became overly reliant on foreign aid and infrastructure investments, exporting to the highest bidder (frequently China or the US) rather than pursuing regional integration. In Africa, the Continental Free Trade Agreement was never concluded (always 2-5 years off). When commodities were no longer a priority they were left short.

The commodities crash was compounded by space-harvesting programmes, which unlocked vast new resources from asteroids.

Prior to the crash, emerging market companies had rushed to go global. Having dominated their home markets, they made rapid moves into new geographies and sectors.

Competition has driven down global profit margins. Companies compete for a limited pool of users, either undercutting incumbents on price, or leveraging profits in industries such as tech, finance and pharmaceuticals to capture users in other sectors. Margins are particularly squeezed in capital-intensive industries, where operational efficiency has become critical.

A key driver for this has been the rapid pace of innovation. In a move to stay on top of new technology developments without stifling innovation, the US-China Global Council agreed an open framework for licensing IP and harmonizing regulation, adopting a light-touch approach to legislation.

Nowadays it's tougher than ever for new companies to break into markets. The 'old unicorns' have taken advantage of new frameworks to control the key platform of data, constantly adapting to stay ahead of regulation, buying up people and datasets and exploiting IP licenses.

A small number of conglomerates battle to be the platform of choice – they control everything from access to virtual communities to blockchain-based legal platforms, from healthcare to your alarm-clock.

Expertise in AI and automated tech help them spot and snap up promising companies. These respond by keeping their best employees and innovative products hidden – no more beta-testing – while also deploying layered data firewalls within their organizations to protect their data from their staff.

Economic gains have disproportionately benefited the elite – those who inherit data and good education inherit the earth. Widespread inequality exists both within and between countries.

Despite rapid economic growth, the middle class is as squeezed as ever and a disempowered public is increasingly dissatisfied with the political elite. Authorities have exploited public health and other data, trading it for intrusive surveillance tools that they can use to monitor and control society.

People are warier of sharing their data following a series of high profile data breaches and cyber attacks.

While trust is low, few can afford to opt out of sharing, as access to full healthcare and benefits depends on it – states provide only a basic minimum. The only decision left is which of the mega-platforms to buy in to. In reaction, the 'Live fast die young' movement has gained popularity – many people choose to ignore financial pressures and live for the now in self-contained communities

For the environment, it's a matter of too little, too late. Lack of global vision and poor governance have resulted in failure to meet global sustainability targets. Despite breakthroughs in energy technology, healthcare and robotics, these have been implemented fitfully, on the whim of individuals and companies. The idea that we would disrupt our way out of problems… well it didn't happen. Decisions were made on the basis of incomplete data – no one could see the full picture. Companies and governments defended their competitive advantage, and in the case of the 2023 "SDG-gate" falsified poverty and sanitation data at an unprecedented level.

The World Cabinet has failed to legislate any meaningful targets for post-national businesses, but consumers face stricter and stricter carbon and water restrictions.

Societies have become more community-centric, organizing into self-contained city units – sprawling metropoles that function as trade and barter hubs.

Borders are open, though a wave of near-pandemics have made travelers increasingly cautious – to avoid quarantine, travelers must consent to continuous monitoring during travel. People move fast, limiting exposure to unknown people or places.

The elite seek out increasingly authentic and personalized experiences. Those who can afford it are living longer and better, while pandemics and poverty are rife in hive cities and other high-density, low income areas.

There is growing corporal inequality – the cosmetically enhanced enjoy cybernetic implants, access to personalized healthcare, life-saving treatments and replacement organs. Those who can't afford such body-work plans receive only basic state healthcare, although some companies now offer health upgrades in return for the right to use your brainpower while you sleep.

Theme	Description
Geopolitics	China takes leadership role on global stage, cooperating with US. G2 world with corporations increasingly influential on global stage. China is the strongest world-trade hub with Latin America, India and Middle East playing an increasing role.
Data	Data is siloed with a few big corporations controlling data platforms/access to technology, while the public are wary of sharing information with other companies. Advances have disproportionately benefited the elite; there is widespread inequality.
Africa and Asia-Pacific	Africa and Latin America prioritized international trade over regional integration and were hit hard when commodity prices collapsed. Middle East economies realign based on new interests in post-oil economy.
Government	Disempowered public are increasingly dissatisfied with political elite. New sensor and surveillance tools used to monitor and limit society.
Security and borders	Borders open, although disease concerns require all travelers to be continuously monitored during travel. People move fast, limiting exposure to unknown people or places.
Privacy and trust	People are wary of sharing their data following a series of high profile data breaches and cyber attacks. Trust is low, but increasingly people are locked in to data platforms.
Business models	Companies seek to control data as the platform of choice, acting to preempt external challengers and seek a first-mover advantage over existing competitors.
Economy	Strong GDP growth, having addressed structural issues of 2000s. Economy no longer dominated by oil – data is the new if inequitable currency.
Values and Communities	Society is community-centric. Elites desire authentic and personalized experiences. Those who can afford it live longer, faster, better, while pandemics are poverty are rife in hive cities and slums.
Environment	Too little too late. Poor decisions led to failure to meet global sustainability targets. Many nations introduced personal market-based incentives, but the World Cabinet fails to legislate meaningful targets for businesses.
Technology	Advances in neuro and biotechnology and healthcare. But inequality in access.

Scenario 4: Resource Wars

(Turbulent World / Closed Data)

An aggressive, nationalistic China emerged in the early 2020s, threatening a US distracted by the aftermath of the 2025 "Water wars" with Mexico. Meanwhile the Middle East and Asia have seen a wave of border disputes and land grabs.

Monetary and trade protectionism dominate foreign policies. The world has splintered into resource trading blocs, with nations striking deals in the hope of achieving some kind of stability in a zero-sum world. Russia has consolidated its own bloc, playing off demand for its resources from East and West. Intensifying rivalries have resulted in the failure of global governance mechanisms and nations prioritize policies that protect and advance their narrow national interest – resulting in a patchwork of regulation.

The growth of the middle classes in emerging economies has not helped. Companies and governments alike rushed to satisfy a new world of consumers who wanted more and better food, faster devices, and to see the world – but they ignored long-term investment decisions and frequently promised what they could not deliver. As the cost of commodities and water drove prices up, they were increasingly held accountable.

With the global economy now in a tailspin following the meltdown of the global financial system in 2030 who knows what will happen next. It promises to be a worse recession than that caused by the 2008 financial crisis, and public and private sector investment in infrastructure looks like it will fall further. Companies already have limited access to capital, and community and crowd-funding has dried up.

Economies are increasingly inward-looking. Inequality between resource-rich and poor regions is growing, and increasingly security and border checks are used to limit movement.

If the 21st century is the century of the city – then India has emerged as the real winner. India realized that virtual and physical connectivity was the key to realizing the economic benefits of its demographic dividend. It prioritized the roll-out of free hi-speed mobile internet and in 2028 the Indian VR Skills Academy was launched, connecting rural and urban communities throughout the sub-continent and with its diaspora.

Having reaped the dividend from its technology and R&D investments in the 2020s, India also became the first post-road economy, leveraging cheap energy from its micro-nuclear-reactors and advances in drone technology to bypass traditional development pathways.

In Africa it has not been so simple. Many resource-rich countries successfully replicated the smart city model – championed by countries such as Singapore in the 2020s –building dense zero-carbon and zero-waste cities, and taking advantage of rapid improvements in sensor technologies, energy and automation. These mega-cities are the new economic powerhouses.

Other cities failed to manage the transition, either by under-investing in infrastructure or being held back by corruption. In these failed cities, the proliferation of slums and a lack of accessible work has encouraged trade in illicit goods, human beings and bootleg robots – and increased violence and organized crime. It was easier and more attractive for people to work on the black market, using micro-payments and blockchain technologies to bid for jobs, contract and settle payments quickly and off the record.

Public authorities are losing the fight for transparency, overwhelmed by the ever-increasing quantity of data. The lack of standards has not helped, and it's harder and harder to see the forest for the trees.

Finally, some countries have seen a proliferation of small and medium-sized cities, growing in a haphazard and unregulated fashion, often in rural and peri-urban areas. These cities exist in an unstable equilibrium – swelling when seasonal and resource jobs are available, but with limited infrastructure and finite resources life gets increasingly difficult when they grow too big. Water and food shortages are common.

The Internet of Everything concepts pioneered in the early part of the century were never realized. Despite efforts to standardize and open up platforms, countries and companies competed to promote their own standard and gain a competitive edge. Increased cyber security and espionage (across the public and private sector) resulted in distrust between both countries and corporations – as well as having a financial cost.

Remember the headlines in 2028 when four of the major biometric wallets were hacked? Those who were unlucky enough to have their genome, iris patterns and fingerprints stolen are still struggling to protect their identity today – and companies had a hard time confirming their users' identities for fifteen years – though peer validation is starting to restore some level of trust.

Nowadays, it's not as simple as buying a smart bulb and expecting it to talk to your smart lamp. Sure, you can go open-source but then you wait months for a bug to be patched – and, of course, security is a concern.

The alternative is to buy into a single provider, basing your life around their brand. But then you're locked in – and if you move cities you may find your new city doesn't have an agreement with your preferred provider.

Younger generations – the Alphas – are less bought into these 'smart lifestyles' than their parents. They are increasingly willing to embrace a less materialistic life and companies have had to adapt to meet demands from a multicultural, multi-generational and ethnically diverse global marketplace. Diversity has also resulted in tension between travelers unwilling to compromise on religious and social values. With limited access to capital and resources, small nimble companies have fared best, with companies 'innovating to zero' – optimizing supply chains and removing middlemen.

Sensor technologies and predictive analytics have helped track, quantify and predict the movement of people, materials and energy – providing opportunities to recombine resources in innovative ways. This circular economy also pervades people's lives – hardly anything goes to waste as communities pool unused capacity, automate redistribution and match supply with demand in real-time. Whether for leftover food, energy or brainpower.

Robotics and AI has been a double-edged sword. In fast-growing markets and developing regions with labor-intensive goods and services, automation has devastated the economy. In many sectors though there have been positive developments.

Streets are safer – AI are constantly on the lookout for infractions, dispatching police and enforcement drones where needed, and routing people away from danger. People spend more time out of hospital, convalescing at home with the help of robot carers, and new jobs have been created. The skills gap has been well managed, with companies and governments striving to democratize education and skills.

At the same time there is tension between consumers and their states, with the public fearful of surveillance by their governments and cities.

There is growing realism about climate change's existential threat to humanity. Environmental activism is on the rise, reacting to water stress and extreme weather. Countries have tried to innovate around the issues – geo-engineering is increasingly used to counter extreme weather, but realism is setting in.

Theme	Description
Geopolitics	An aggressive, nationalistic China emerges and threatens a US distracted by conflict. Meanwhile the Middle East and Asia have seen a wave of territorial disputes and land grabs. The world has realigned into resource trading blocs.
Data	Cyber security and espionage have resulted in distrust between both countries and corporations. The Internet of Everything has not been realized. Countries and companies compete for access to skilled and technical expertise.
Africa and Asia-Pacific	India emerges as the fastest-growing economy in 2035, having successfully managed its demographic transition and invested in infrastructure and water technologies.
Government	Increased authoritarianism as governments enforce restrictive policies. Growing shadow economy as governments fail to capitalize on promise of new surveillance and big data technologies.
Security and borders	Gaps widen between resource-rich and poor regions, and security and border checks are used to limit movement between regions. Physical security is increasingly important due to virtual identity theft.
Privacy and trust	Regional instability and conflict, coupled with failure to sort out slums has encouraged trade in illicit goods, human beings, robots (and increased violence and organized crime). Public increasingly distrustful of institutions due to fear and corruption.
Business models	Small, nimble companies fight to occupy niches – organizations are stripped back to bare bones as they look to become zero-waste to reduce reliance on foreign nations. Rise of the circular economy.
Economy	Economic growth stalls. Companies have limited access to capital, and both private and public sectors fail to invest in infrastructure and innovation. Economies turn inward.
Values and Communities	Growing diversity is an increased source of tension among communities, who are unwilling to compromise on values as consumers. In many countries Generation Alpha are ready to embrace a less materialistic life. Multiculturalism.
Environment	The environment has not been prioritized, but there is growing realism about climate change's existential threat to humanity. Limited resources have led to the rise of the 'circular economy.
Technology	Robotics and Artificial Intelligence have altered the nature of work. Service robotics, health robotics and policing are ubiquitous.

Section 5 – Implications and Recommendations for the Sector

The implications of changes in the global macro-environment that will affect the airline industry over the next 20 years and beyond are based on our analysis of material from different sources. This includes workshops held with over 50 airline industry representatives, interviews with experts from academia, industry and government, and our construction of potential interactions of 11 themes drawn from this research across four hypothetical future scenarios (see section 5).

A second industry workshop was held in June 2016 (at the IATA AGM) to review the full set of scenarios and consider what their implications might be for the airline industry.

During this workshop, we used a 'wind-tunneling' method to identify and assess actions that airlines might take that would have a positive result in different scenarios, and to identify plans and policies that could be expected to succeed in more than one (ideally all) scenarios. The scenarios are not predictions of what will happen, but between them contain our best assessment of developments and events that might be expected to happen. As such, they are a useful test-frame for policies and actions.

We focus here on implications and recommendations for policy that we consider robust across the four scenarios, even if some are more relevant in certain outcomes. For example, a resilient supply chain is critical in the 'Resource Wars' scenario where there is increased conflict; while investment in alternative fuels is particularly important for the 'Sustainable Future' scenario in a low-carbon world.

Within each of the categories we have identified a selection recommendations for IATA and its members (blue boxes). These recommendations take into account deliberations with IATA's Industry Affairs Committee.

A list of the recommendations is provided in Annex D.

1. Geopolitics

1.1 GEOPOLITICAL TRANSITIONS AND REALIGNMENT

We are already seeing tensions geopolitical arena as we experience a long-term shift of wealth and economic power from West to East.

Existing international institutions such as ICAO, UNWTO, U2, and the G20 will be increasingly challenged. China is already asserting its influence through bodies such as the New Development Bank (NDB) and the Conference on Interaction and Confidence-building in Asia (CICA).The US may step back from international commitments, China may undergo a debt crisis, or the EU may continue to fragment after Brexit and with the rise of right-wing protectionist groups, thus presenting opportunities for the other regional powers to increase their influence.

As this transition takes place, competing standards may arise, not only for regulation, but also for security and consumer protection. There could be a split between an Eastern and Western approach to aviation governance.

Implications

To ensure global standards, the sector will need to support the role of existing international institutions. It will also be necessary to work with new institutions to extend and reform legislation and test new approaches in a push towards greater harmonization.

As new countries and regions become more dominant, effort should be made to understand the role of new institutions at both a national and regional level, and to ensure balanced representation in global discussions.

Recommendation 1: IATA should continue to support global standards bodies such as ICAO, and think strategically about how the relationship between IATA and these institutions will evolve. It will be important to maintain global standards for a global industry, especially in futures that are increasingly multipolar or where there are shifts in the balance of power.

Recommendation 2: IATA should engage early with new institutions (such as the New Development Bank) in order to play a more significant role in enacting or influencing aviation policy in the top markets in 2035 (China, US, India, UK, EU and Indonesia) .

1.2 PEACE AND SECURITY

Over the past 30 years there has been dramatic growth in international trade, driven by rapid globalization and accompanied by a shift towards democracy. Over the coming 30 years there is uncertainty as to whether this will continue.

If the current political volatility continues, new conflicts may disrupt the movement of both people and goods. War would have both an immediate and long-term impact on tourism, infrastructure and people's ability and willingness to travel.

Conflict involving major states may damage global supply chains, especially where states have a monopoly on particular raw materials.

Even without conflict, perceptions of terrorism risk will have a significant influence. For example, up to what point will the insurance market continue to cover airline risk?

While some of these risks will be outside the control of the airline industry, insurance premiums may be kept down by introducing technology to limit human error (e.g. automated planes) and to counter cyber risks.

Implications

Could safety and security become important differentiators for airlines?

Airlines will need to maintain robust, redundant supply chains to protect themselves from global wide-scale disruptions. They should look at the possibility of introducing new technology to limit increases in insurance premiums and explore the possibility of global airline insurance.

Recommendation 3: IATA should advocate for greater flexibility in routing and scheduling that might allow airlines to deal wiht implications of capacity issues caused by conflicts and other major disruptions.

Recommendation 4: IATA should develop an "emergency response" set of guidelines and procedures that could be implemented rapidly by airlines if the security situation becomes more turbulent. These may include passenger screening, data sharing and security procedures.

1.3 NEW FRONTIERS

Future conflict (or cooperation) may originate in many areas as nations seek to appropriate or colonize new territories, from outer space to the oceans, for access to natural resources and land, or technological or military superiority.

China has recently launched its first quantum telecommunications satellite.

Private actors may play a role as companies such as Deep Space Technologies and Space X take on roles traditionally the domain of governments.

Implications

The industry will need to build relationships with private actors as well as governments, particularly since governmental focus on airlines' needs may be diverted towards new entrants such as space technologies.

2. Africa and Asia-Pacific

2.1 NEW MARKETS

The global population is expected to reach 8.5 billion by 2030 and 9.7 billion in 2050 with half the growth to 2050 coming from India, Nigeria, Pakistan, Democratic Republic of the Congo, Ethiopia, Tanzania, the United States, Indonesia and Uganda.

Out to 2030 there is optimism over the impact Africa will have as a new global political and economic force, and growth of middle classes in China and Asia-Pacific, with impressive spending power.

As new markets come online it will be important to understand not only where the customers are, but how they will consume, including their travel preferences, price sensitivity and the role of diaspora communities; also the potential of these new markets as a source of labor and capital.

One risk for airlines is that uneven and volatile economic growth may result in funds being "trapped" in countries unable to repatriate them on account of foreign currency export restrictions.

Implications

The industry should build market intelligence to understand the potential of new origins and destinations. The IATA passenger survey is one mechanism for understanding customers' propensity for travel and preferences for different services. However further work may be necessary to explore how the industry can meet customers' needs.

Recommendation 5: IATA should increase its engagement with stakeholders from Africa and Asia-Pacfic (governments, think-tanks and other bodies that influence government policy) to deepen the industry's knowledge of how decisions are made and how those decision-making processes will evolve. This will ensure that regulations introduced do not limit the potential of these markets.

2.2 INWARD OR OUTWARD

Growth in air travel is likely to be driven by domestic and regional flights in fast-developing markets in Africa and Asia rather than existing international routes. Where connectivity has been limited for decades, the pace of change is likely to increase even more dramatically.

Against this, geopolitical, environmental and other challenges may slow the development of these markets, and some countries may choose to build preferential trading relationships with states that offer infrastructure investment in return for resources, rather than using market-based criteria. This may limit the potential for intra-regional growth.

Urbanization is a strong trend in many developing countries, but not all cities will be created equally. While the vision of urban powerhouses and smart cities may be realized in some places, elsewhere there could be failed cities, slums and a lack of infrastructure. Other places may not choose to prioritize air travel.

In Africa, political and social tensions may limit the growth of intracontinental hubs, and poverty, corruption and bad governance may hold things back.

Implication

Advocacy on infrastructure development could be focused on particular countries (for example, encouraging China to invest in certain African states), however strategies should consider the potential distorting effect on regional traffic flows.

International airline groups should consider investments in emerging as well as traditional markets, and should communicate the value of aviation to emerging markets, highlighting the social as well as economic benefits.

2.3 HUBS AND SMALLER AIRPORTS

High-speed trains are likely to take business from airlines over shorter distances. Some new technologies, if they prove viable, may also compete on performance by providing faster connections over longer distance (e.g. hyperloop, drone companies, unmanned aircraft companies, and private actors such as Space X).

As this happens, the role of airlines may shift to long-haul international flights, making relationships with other transport providers more important.

At the same time, there may be a shift towards more point-to-point travel. Secondary and tertiary airports may benefit from efforts to combat increasing congestion at hubs.

Implications

The sector should take a more holistic approach to infrastructure development and establish closer relationships with providers that are not just focused on air transport infrastructure (e.g. urban planners).

IATA could help develop relationships with 'new' forms of transport. Options include partnerships and development of shared infrastructure to boost passenger flows, as well as improving connections between different modes of transport. This would improve access to airports in large population centers, and direct connections with such locations will enable faster and more efficient growth in connectivity.

Recommendation 6: IATA should foster relationships with secondary and tertiary airports. These may offer additional capacity in situations where hubs become overcrowded, or where new technologies, automation and business models allow airlines to bypass hubs and establish new intermodal connections (e.g. Uber-type business models).

3. Security and borders

3.1 BORDERS OR CONDUITS

Open borders and movement are positive for the airline industry, and as the process of moving people and goods becomes more seamless and automated, the industry can increasingly position itself as the conduit of choice for people and goods.

Global instability, however, may lead to nations building higher walls. For example, restrictions may be imposed on travelers through tougher visa rules or travel restrictions.

If countries do impose more border controls, airport borders still maintain the advantage of being relatively easy to police compared to land or sea borders.

Implications

Airlines should campaign for greater connectivity, making the case for supporting tourism and trade by reducing costs, easing visa rules and offering incentives to appeal to growing markets.

At the same time, the industry should continue to innovate and invest in security to ensure that aviation continues to be the conduit of choice.

3.2 INFECTIOUS DISEASES

There is likely to be increased risk from infectious diseases, particularly given the rapid pace of urbanization.

The traditional view is that airports can be a hotbed of contagion. In a world where restrictions are in force, however, the airport becomes a strategic asset for countries to control flow and spread.

As technology drives down the cost of detecting, diagnosing and treating infections, airports and airlines may increasingly become assets in managing infectious disease, rather than being perceived as a risk.

Implications

Airlines may be asked to take on more responsibility for monitoring and mitigating the spread of pandemics, despite the fact that responsibility usually lies with governments. The industry may benefit from working with WHO to ensure governments are aware of their role in pandemic response.

The role of airlines as a strategic asset supporting governments' public health objectives for both detection and containment of diseases could also be highlighted.

Recommendation 7: With the increasing risk of pandemics, a global approach to managing infectious diseases becomes ever more important. While airlines need to be vigilant and prepared, IATA should also stress the increasingly important role that all stakeholders, particularly governments, need to play to ensure that responses are in line with WHO guidance and international health regulations.

3.3 BIOHACKING

As the cost of technology continues to fall, connectivity increases worldwide and knowledge becomes more accessible, we will see the growth of home-made technology and biohacking. For example, 'DIY' open source diabetes equipment is increasingly being used by Type 1 diabetics, while neuro implants are being used to treat paralysis.

As use of home-made technology becomes more widespread, it creates challenges for security and monitoring.

Without regulation and monitoring, it will be hard for security to stay on top of a proliferation of devices and technologies.

Implications

Additional screening regulations are likely: the industry should advocate for such regulation to be harmonized globally and 'smart'.

More changes may need to be made to improve the processing of passengers, such as standardizing screening, introducing new technologies, ensuring passenger data is available and streamlining security.

Recommendation 8: IATA should work with appropriate organizations to drive the establishment of globally harmonized standards to address biohacking.

4. Environment

4.1 SUSTAINABILITY LEADERSHIP

The increasingly visible impact of climate change, from habitat loss to resource scarcity, is likely to harden public attitudes, and increased attention will be paid to these issues on the global stage.

The Sustainable Development Goals (SDGs) were ratified in 2016, setting out ambitious global targets for the next 15 years. As nations adopt these targets, both governments and consumers may become increasingly demanding of the aviation industry.

Implications

In addition to building ties with national governments and regulators, there is an opportunity for airlines to strengthen their global public reputation as the "provider of essential connecting infrastructure that serves people, rich and poor, around the world."

Recommendation 9: IATA should continue to support the industry's efforts on environmental sustainability and re-evaluate, on an ongoing basis, its activities in this area. Environmental performance is one of the key elements of society's changing expectations of aviation and an element which becomes increasingly critical in a resource-constrained world. But sustainability isn't environmental alone, and countries' expectations of airlines will move beyond the environmental sphere. In that vein, IATA should explore other ways in which the industry has or can have a positive influence in the world, potentially linking these to the UN Sustainable Development Goals 2030.

Recommendation 10: IATA should establish an industry-wide corporate responsibility programme, with a focus on transparency, safety and the environment that could help IATA to drive global standards and ensure the sector remains competitive in a world where there is increasing competition from other transport modalities.

4.2 CONSPICUOUS CONSUMPTION OF ENERGY

Demand for jet fuel may be reduced by the use of biofuels or the introduction of new engine and aircraft designs. Meanwhile alternative energy sources will come into use outside of aviation.

If adoption of new technologies by the industry is slow, airlines increasingly run the risk of being seen as "conspicuous consumers" and face increasing pressure in a low-carbon, renewables world.

Airlines that invest in alternative fuel technologies or radical designs may be perceived positively by travelers and increase their share of the market.

Implications

The sector should continue to support efforts to improve environmental sustainability.

To accelerate industry investment in this area, government support will be needed to develop a sustainable market for alternative fuels, for example by investing in biofuel development and infrastructure.

The approval of the ICAO Carbon Offsetting and Reduction Scheme for International Aviation in October 2016 provides momentum for further industry efforts reaching beyond traditional market-based measures (operations, infrastructure and renewables). The sector should continue to promote research into, and production and commercialization of alternative fuels.

5. Economy

5.1 GLOBAL ECONOMY

Over the past ten years there has been growing awareness of the interconnectedness of the global economy, and its volatility is unlikely to decrease during the next 30 years.

To address this volatility, the industry would benefit from an 'early warning system' to identify potential disruptions and systemic risks, as well as changes in social attitudes.

The industry already has robust economic modeling, but new approaches such as crowd-sourcing may help airlines better monitor and anticipate changes to behavior and sentiment.

There may also be a case for developing an industry safety net, or new models for sharing exposure to infrastructure investments, taking into account boh the airlines' economic and wider social value.

Implications

It is important to continue to identify, monitor and share information on sources of disruption from outside the aviation industry, and may be useful to track changing social attitudes as well as economic metrics.

Recommendation 11: IATA should create an internal early warning group with the task of ensuring that the industry is prepared for possible threats. This group could distill a set of early warning indicators from this scenario report and similar publications, create a timeline of expected developments, and update it regularly.

5.2 POST-OIL ECONOMY

Contingency plans are already in place for sustained high oil prices (or scarcity) and the expectation is that fuel efficiency and a drive to reduce greenhouse gas emissions will be the key determinants over the next ten years.

However, while a post-oil aviation industry may be unlikely in the next twenty years, it is possible that an energy breakthrough may occur in other areas, such as nuclear.

A sudden surplus of energy would have a destabilizing effect on the price of oil. It could also reshape the debate about fair competition and liberalization, while a more gradual diversification may over time have the same affect.

Implications

The industry should plan for radical disruptions to the energy market, beyond oil price fluctuations.

In developing a plan for post-oil economies, there is an opportunity to position the aviation sector as a means of facilitating economic growth, economic openness and global trade.

5.3 WORKFORCE AND SKILLS

Aviation depends on high-skilled employees, whether pilots, engineers, air traffic controllers, or safety inspectors. In the medium term there may be skill supply issues due to the increased demand from emerging markets.

In the longer term we may see more fundamental changes to the nature of work. Already there are shifts towards on-demand work, taking advantage of new technologies to allow people to work when and where they want.

New technologies including AI and automation will fundamentally change what work is perceived to be.

While some jobs in the aviation industry will be shielded, it is likely that others will evolve e.g. customer service will focus on the tricky rather than the routine, and accounting and legal work could be disrupted by blockchain-type technologies.

And as the nature of work changes globally, expectations of remuneration and incentive structures will also shift. The work 'contract' – moral as well as legal – will change. This is likely to be accompanied by unrest in the workforce.

Implications

In the short-term the industry will need to invest in skills and structures to keep pace with a changing workforce, and position aviation as a sought-after industry for young job-seekers. It may also need to use new technology to 'fast-track' the gaining of 'experience', specifically for pilots.

In the medium to long-term it will be necessary to manage the transition to automation, which may require a smaller workforce. This transition will need to be managed with the unions and regulators.

Recommendation 12: IATA should develop a plan for educating and influencing the next generation of airline industry employees and users (e.g. 15-25 year olds). As new technologies and value shifts change how and why people work, the industry will need to invest in skills for future aviation leaders and workers, and communicate the benefits of working in the sector.

6. Data

6.1 DEATH OR REBIRTH

Airlines may struggle to defend their position as a distinct, autonomous industry, faced on the one hand with substitute transport options, and on the other with a fundamental challenge to their business model from data intermediaries that increasingly 'own' the customer and view airlines as a commodity supplier of space on aircraft.

"Big data" companies represent an immense threat and also an opportunity to airlines. Google, Amazon, booking.com are examples of companies that take a forward-thinking approach to their handling and analysis of data, but also in their commercial thinking.

These corporations could take over customers, steer airline demand and network shapes, frequencies and schedules.

A parallel from a different field – and where a data strategy was initiated too late – is the attempt by journalism to wrest back control over news content and data from organizations such as Google and Facebook.

Or do airlines overestimate the market power they have? Does it reside in more than their ability to give customers a great deal?

Implications

Airlines should prioritize developing a data strategy. They can argue that their systems for handling data – including passenger information – are generally robust and respect privacy. They should explore (before it's too late) opportunities for partnering with consumer-facing software and data companies who wish to connect with the data owned by airlines and who commit to respecting the integrity of that data. An alternative may be to acquire companies that can hold their own against the data companies, but airlines may lack the capital as well as the will to do this.

At an industry level, airlines need to make the case for their ownership of data, including efforts to standardize data (where appropriate), mechanisms for gathering and sharing data safely for both commercial and operational purposes (including disruption management and passenger communications). This will require investment in both systems and skills.

At an industry level, airlines should try to ensure that any new government regulation of data is proportionate by developing voluntary initiatives and standards, including principles for protecting customers' data.

Recommendation 13: IATA should consider measures that support airline ownership of data (e.g. safeguarding privacy, commitment to common data protection procedures), and look to establish a global industry-wide position on data protection. A more open approach to data and interoperability at a global and industry level may be more positive for the industry and for consumers.

6.2 FREQUENT FLYERS AND PERSONALIZATION

Airlines cannot build brand loyalty without having access to passenger data. They also need this data to understand customers' needs. With an incomplete understanding of spending and decision-making habits airlines must rely on correlation rather than hard data.

Frequent flyer programs will become less effective as customer loyalty shifts to big data corporations and their incentive systems.

Implications

To protect against the weakening of the airline-customer relationship as data companies encroach on their market, the industry should explore strategic partnerships with data companies now, while in a position of relative strength, and while their brands are still strong.

6.3 SUPPLY AND FLOW

Advances in data processing, sensor networks and geographic information systems are already shaping aspects of the air industry, from purchasing and decision-making to supply-chain flows, aircraft routing, financial relationships with partners, and movement of people through airports.

As more information becomes available, the industry will increasingly be able to recognize, anticipate and apply advances.

In maintenance, repair and overhaul – but also flight operations – a combination of new sensor technology and smart materials will allow real-time analysis of components in airplanes, potentially redefining how the contracts they enter into, for example by specifying performance, not parts.

Implications

Airlines could use advances in sensor networks and materials to look for new ways to negotiate contracts with their suppliers.

Technologies such as blockchain have the potential to change how financial and other transactions are recorded, agreed and settled.

Recommendation 14: IATA is already in the process of exploring how to take advantage (and manage risks) of new technologies such as blockchain. We suggest also looking at the effect this and other new technologies can have on the business relationships on its member airlines. Can blockchain play a role, for example, in rebalancing the value chain?

7. Privacy and Trust

7.1 TERRORISM

Will the industry keep pace with (or be able to anticipate) new forms of terrorism enabled by the democratization of technology, including the risk of hacking and malicious use of drone technology?

Will passengers have to get used to intrusive security procedures, as already applied in some airports ?

At the same time, airports are in many ways easier to secure than train stations, buses and metros, while rigorous security measures further enhance passenger safety.

Implications

Airports can claim to be relatively safe places compared to many other public spaces such as rail stations, and also benefit from strong experience in security provision.

At the same time, a significant challenge remains to secure land-side access to airports, particularly as these land-side infrastructures increase in scale.

Recommendation 15: The industry should monitor proposals to extend or evolve the security cordon around airports to ensure that governments continue to be ultimately responsible for the safety of their citizens.

7.2 CYBERSECURITY

There is growing awareness and concern about threats from cybersecurity.

As systems and planes become increasingly automated, the risk and potential impact of an attack or breach will continue to grow.

While the industry can take steps to develop robust, secure systems and minimize risks within the supply chain, the proliferation of standards and devices will make it harder to secure its own assets.

Meanwhile, technology-laden passengers and cargo present additional targets outside of the industries' control.

Implications

It will be important for the industry to take an active approach to cybersecurity, harmonizing standards, and developing prevention and detection strategies that move beyond their own systems to deal with risks associated with passengers and cargo.

Recommendation 16: IATA should consider establishing an information exchange mechanism for airlines to share information on cybersecurity threats (as part of a cybersecurity strategy). Cybersecurity is likely to be a major issue that will require the industry to work with companies across the entire supply chain, as well as governments to manage risk.

7.3 PERSONAL PRIVACY

Expectations of personal privacy will be tested and the issue will become an area of attention for regulators, who will have trouble keeping up with the pace of change.

Will people be willing to give up data in return for other benefits, and how will they be incentivized to do so?

Implications

There is an opportunity for airlines if they are able to develop the range and quality of their services to customers using the data they hold, while demonstrating that they are secure guardians of passengers' confidential information. An industry-wide commitment to privacy may avoid the need for regulators to intervene in this area.

8. Technology

8.1 SHARING AND POST-SHARING

Startups are likely at some point to seek to develop alternatives to the airport hub model by flying planes from even smaller airports than those favoured by today's new model airlines.

'Passenger drones' or variants on personalized aircraft (for example with rooftop take-off) may have some impact, but a more substantial threat may come from the extension of an Uber-type algorithm-based integrated transport system that links up small aircraft capacity at local airfields (possibly upgraded with 'remote tower' technology) to provide medium to long distance ground-air-ground travel options.

Meanwhile, competition for traditional parts of the freight supply chain may come from new places, for example Deliveroo in the UK is pitching itself as a next-generation logistics company.

Implications

Airlines need to identify these challenges ahead of time and act on this research, by inviting new operators to link to established hubs and airlines, and potentially by taking ownership stakes in likely challengers.

The industry could highlight the opportunities for startups to provide services that complement those offered by airlines in transport, MRO and other sectors.

Recommendation 17: IATA should engage with novel transport providers (hyperloop, drones, unmanned aircraft, space travel companies) to explore potential cooperation as well as shared needs. In a future where passengers want to travel faster and prioritize convenience, seamless travel and connections between providers will become increasingly important. One option may be to widen IATA membership to include air transport operators who are not airlines.

8.2 AUTOMATION OF PLANES

Technology in self-driving cars may pave the way for more relaxed attitudes to automation. At the same time, there will be risks around the co-existence of piloted and pilotless flights in the same airspace (a risk already present with drones).

Technology already enables pilotless flights. Freight shipment represents an opportunity for airlines to develop cutting-edge technology without watering down their commitment to passenger safety.

Safety checks, loading and transport of freight could be automated progressively, bringing efficiencies for freight forwarders and reducing costs for airlines.

Implications

The industry should work with other industries to ensure that aviation benefits from standards and regulation developed in other domains.

Regulators need to understand that the rules for the aviation industry will require a separate elaboration process from that followed for driverless cars.

Recommendation 18: Automation is expected to have a significant impact on transportation and logistics. To ensure that the airline industry benefits, IATA should establish a working group including both manned and unmanned aircraft operators to facilitate standard-setting and information sharing.

8.3 SUBSTITUTION

The ultimate substitution challenge for airlines comes from people deciding not to travel. Although claims for remote working and videoconferencing systems have not been realized so far, as prices fall and the technology becomes mainstream, the next generation of virtual (VR) and augmented reality (AR) systems may make travel an expensive luxury for many business purposes, and could also make inroads into the consumer market.

As social attitudes change and a new generation of travelers brought up on these technologies comes online, it is likely there will be increased demands on airlines and airports to integrate VR and AR into their entertainment and operational offerings.

Implications

There is a need to explore opportunities for virtual and augmented reality to supplement rather than replace travel experiences. This would include the passenger experience when choosing destinations, or entertainment in-flight and in transit.

8.4 AIRPORTS OF THE FUTURE

Will airports expand to become "aerotropoles"[2] – developing their own hinterland and ecosystem of services – or shrink as ground-air interconnections become more seamless?

This will be determined in part by the demand for and cost of human resources in the airline industry. Technology improvements mean that both in-flight and airport services may increasingly be automated in the name of efficiency, and possibly safety.

Implications

It is also possible that rather than being eliminated, human resources could be redeployed to improve the flight and airport experience and capitalize on passenger flows, extending the current airport shopping and hotel experience to a range of other facilities.

There is a risk that airports, at an individual or global level, may seek to secure revenue by introducing initiatives such as commitment charges for unused slots, new mechanisms for trading or auctioning slots, or new contractual terms.

The way airlines are factored into planning processes for airports may also evolve, and the sector may want to take action to ensure airlines are fully integrated into the planning process.

Recommendation 19: IATA should build relationships with those responsible for urban planning (not just air infrastructure authorities) to ensure industry needs are linked into infrastructure planning, particularly when there are major plans for developments around airports.

Recommendation 20: IATA should use the strategic review of the Worldwide Slots Guidance as one mechanism to improve the efficienct use of capacity and guard against revenue commitment and market allocation of slots.

[2] John Kasarda, Director of the Center for Air Commerce, Kenan-Flagler Business School; University of North Carolina; CEO Aerotropolis Business Concept

9. Values and Communities

9.1 CONSUMER EXPECTATIONS

Will the traveling public be ready to accept lower levels of comfort to enjoy lower costs? Or will flying become (more so than it is already) a destination, hobby, experience? Or might both happen?

Parties and weddings on airplanes could become commonplace. Children already want 5-star hotels and expect an 'always on, always connected' data world.

Affluent travelers will demand special (including segregated) treatment at all stages of the journey, which could result in an increasing divide between classes.

Consumers may organize using new technology to challenge the pricing power of airline systems ("Groupon effect" versus yield management systems).

Implications

There is a big prize for airlines that demonstrate the ability to take care of all passengers, whatever their needs.

Although the cost of doing this is significant, the automation of some roles currently filled by airline staff may allow the retraining and reallocation of personnel to make this happen.

9.2 DIVERSITY

An increasingly diverse customer base (nationality, ethnicity, religion, language) will have significant consequences, from dietary requirements to religion and prayer times.

Organizations representing the needs of different groups will demand new processes, procedures, and regulation.

More multilingual staff will be needed. As a result of the growth of China's middle class there are already more than 100m Chinese passengers who don't speak English. This will increasingly place new demands on cabin crews.

'Simplifying my life' will be of increasing importance to a large number of busy people. Some may want the shopping and restaurant experience; others would prefer a direct path to the boarding gate.

Implications

Where possible, airlines should use their influence with partners and suppliers to speed up, simplify and make more agreeable the full, door-to-door passenger journey. The new generation of travelers, raised on smartphones and journey planners accurate to the minute, have less patience with unnecessary time spent in airports, and particularly in queues. Passengers may be willing to share the information necessary to smooth their journeys.

9.3 PASSENGER CARE

The aging demographic of many (particularly developed) countries means there will be more old and infirm people wanting to travel by air. Airlines will benefit from efforts to make their experience safe and comfortable, both on board and in the airport. Also, many new passengers traveling long distance will not have a good level of English or another commonly used language at their destination, and will require support from ground staff on arrival as well as in the air.

Healthcare may need to be provided in airports and in planes, and robotics may be an efficient and safe way to cater to some needs.

As demand for travel increases, it may be increasingly difficult to turn planes around rapidly, for instance as the percentage of people needing wheelchairs or assistance increases. Will planes need doctors or other medical staff on board[3]?

Implications

The physical infrastructure of planes and airports may need to be radically redesigned to facilitate accessibility.

In the short-term planes may need to carry more medical devices, supplies and staff. It may be possible to use 'traveling health-care professionals' and advances in healthcare robotics, as well as therapeutic devices.

Recommendation 21: IATA should establish core principles on facilitating the travel of older passengers and those with reduced mobility. An increasingly active aging population and changing attitudes to disability are likely to result in a greater need for the industry to support passengers with special requirements, for example on account of age, medical need or disability.

[2] John Kasarda, Director of the Center for Air Commerce, Kenan-Flagler Business School; University of North Carolina; CEO Aerotropolis Business Concept

10. Government

10.1 INFRASTRUCTURE

The multi-decade time frame for investment in infrastructure is a challenge, especially coupled with political indecision. Who will fund infrastructure of the future?

Investment will clearly be needed to meet changing expectations and demand for travel. However, differences in the level of commitment of governments to the aviation industry, or lack of finance means that some cities or regions will get left behind.

Countries with longer planning timeframes (including some authoritarian governments) are likely to gain the upper hand in the timely provision of infrastructure.

Implications

The sector should encourage governments to take a joined-up approach to transport, to enable multi-modal strategies to flourish and reinforce the need for global coordination.

This should be part of the argument for the wider value of aviation as the 'internet of transportation', with seamless switching at the national and global level.

Recommendation 22: IATA should keep an eye out for aviation funds being diverted to 'new frontiers' (such as space travel). It could also prepare a list of infrastructure issues on which the sector may need to advocate in the future. Where regions have insufficient state finance or commitment to the sector, it may be necessary to look at alternative funding models.

10.2 FINANCIAL AND SAFETY REGULATION

Advances in data and analytics will offer new ways for governments to monitor, understand and intervene in the lives of both citizens and businesses.

Governments are likely to demand more information to help them monitor the impact of market interventions, environmental standards, efficiency and safety regulations.

The industry may benefit from taking the initiative in opening up data, thereby demonstrating their openness, as well as their safety record and environmental performance.

Such a shift would also help the industry address consumer concerns in these areas.

Implications

The industry could choose to put in place measures to monitor performance and share this information with governments and the public.

10.3 MILITARY AND GOVERNMENT OWNERSHIP

Having a flag-carrier could turn out to be an act of foresight if the world becomes more threatening and more protectionist.

Fleets and other equipment may be requisitioned by the military. In other circumstances, international connections may be required to be kept open when not commercially justifiable.

Should governments pay an 'insurance' premium to airlines in exchange for the right to commandeer aircraft in emergency? (Power stations are paid a premium to have extra power available in case there is a surge in demand for energy.)

This would be at odds with recent moves towards "open skies" relaxing of ownership and control rules.

Implications

Medium-term capacity choices are affected by government ownership of airlines in some markets.

At times and in some countries there may be increased political pressure to serve specific underserved destinations.

Flight routes should be seen as strategic infrastructure that needs protection and investment.

11. Business Models

11.1 NEED TO INNOVATE

The airline industry has seen few fundamental challenges to business models over the past 30 years, except for the arrival of Low Cost Carriers (LCCs) and the introduction of alliances.

Airlines struggle to differentiate themselves, competing on network availability and to some extent on pricing and service. Profitability remains low.

There is the potential for airlines to take advantage of advances in automation, new transport modes, and consumer attitudes.

Customer service, social values, and simplicity will become increasingly important as consumers expect more personalized solutions.

Companies that control data will have an advantage over existing competitors in developing new niches.

It is important for airlines to consider whether they should compete with newer, asset-light data companies or instead build relationships.

Implications

The industry will need to focus on customer service and interaction with passengers.

It will be important to leverage existing strengths, including reputation as a trusted, safe and mature industry .

11.2 CATERING FOR NEW CUSTOMERS

Who are going to be the customers of the future and what will they want?

The global population continues to grow at a significant pace, which will mean more passengers from both existing and new markets.

One fairly well predictable and powerful theme is the growth of the middle class in emerging markets, particularly India and China. IATA should make every effort to understand these customers and their preferences though targeted surveys.

It is also clear that the average age of customers is increasing, and therefore airlines need to be equipped to cater to the needs of older passengers or passengers with reduced mobility – not just in the air, but at every stage of their journey.

Implications

Further research is needed to understand who the new customers are, their needs and what they will expect from airlines.

Recommendation 23: IATA should make every effort to understand consumer attitudes in emerging markets, as well as how government and business in these countries view the role of the airline industry, in order to get ahead of potential future regulation.

Conclusion

To consider the future of a major economic sector – one important in its own right and which in addition provides vital connecting infrastructure for the lives and livelihoods of a large share of the world's population – is an exciting but also daunting task.

This study identifies the many factors and forces ('drivers of change') that we need to keep an eye on when taking decisions that shape the future of the airline industry and, directly or indirectly, the lives of the millions of people that depend on it.

It also sets out some scenarios that the industry may face in 2035. In order to create these, we have had to construct – using the drivers of change and many hypotheses – how the world may have changed between now and then. We hope the scenarios are helpful in providing a sense of the scale of the changes that will occur. One thing we know for sure is that 2035 will be very different from today.

With the help of IATA and in particular members of the Industry Affairs Commiittee, we have identified an initial set of implications of these drivers of change and scenarios for the airline sector as a whole, and based on these, have set out some recommendations.

You may or may not agree with the implications and recommendations. What is unlikely though is that these lists are complete as far as your business is concerned. As an industry-level organisation, IATA's role is not to look at the ways individual organizations are exposed to or can benefit from changes in their external environment. Some factors will be important for a particular airline but not for another; some changes will be positive for one part of the industry supply chain and negative for another; or good for one region and less good for another.

We therefore encourage you to do your own thinking. Use the drivers of change and scenarios to consider the future of your business or institution, as the case may be. How well would your organization be doing in each of the scenarios? What changes could it make to be better prepared? How can you incorporate findings in future plans or strategies?

Consider getting people from different parts of your organisation involved in this thinking, even your suppliers and customers. Build these perspectives into your strategic planning process.

We hope that the material in this report will provide some guidance over the months ahead, but more importantly that it will spur new thoughts and catalyze new ideas. We look forward to updating it when new drivers of change enter the scene, or ones that we have underestimated surprise us (as they will) – there is no last word on the future!

Annex A – List of Interviewees

Interviewees

IATA and SOIF would like to thank the following for generous contributions of their time and expertise during Phase 1 of the project.

- Carlos Grau Tanner, Director General, Global Express Association
- Ian Pearson, Futurizon
- Luc Tytgat, Director, Strategy and Safety Management Directorate, EASA
- Robin Hayes, CEO of JetBlue
- Roger Dennis, Director, Innovation Matters
- Rosemarie Forsythe, Former Director, International Political Strategy at ExxonMobil
- Sheila Remes, Vice-President of Strategy, Boeing
- Ben Page, CEO, Ipsos MORI
- Harry Woodroof, Head of Personnel Research, UK Royal Navy
- John Kasarda, Director of the Center for Air Commerce, Kenan-Flagler Business School; University of North Carolina; CEO Aerotropolis Business Concept
- Tony Tyler, former CEO of IATA
- Margaret Tan, Director of Air Transport, Singapore Civil Aviation Authority
- Peter Gerber, CEO, Lufthansa Cargo

Additional contributions

- Conrad Clifford, RVP for Asia Pacific, IATA
- Carole Gates, Industry Risk Management & Insurance, IATA

Annex B – Driver Prioritization

During the online assessment exercise, participants were asked to assess the 50 drivers of change to identify those that (a) were likely to have a high impact on the sector out to 2035 and (b) where there was a high level of uncertainty as to what that impact would be (see Figure X).

A set of thirteen drivers (Set 1) was identified as having greater than average impact and uncertainty. These drivers indicated 'critical uncertainties' that we would reflect in the scenario development.

Four additional sets of drivers were considered important when developing the scenarios: the top ranked drivers based on a single criteria, (impact – Set 2) or uncertainty (Set 3) and those where the industry showed less consensus on the scale of the impact (Set 4) or uncertainty (Set 5) out to 2035. Each of these sets contains additional drivers that were considered during development of the scenario themes and individual scenario narratives.

The high impact, but relatively certain drivers (Set 2) included Middle class growth in Asia-Pacific, Global population growth, Internet(s) of Things, and New aircraft designs, and International regulation of emissions and noise pollution. Meanwhile, high uncertainty, lower impact drivers (Set 3) included three additional environmental drivers – and it was interesting that environmental drivers were generally ranked more uncertain that other STEEP categories.

Finally, we looked for drivers that had a greater variation in voting by participants i.e. those drivers where there was less consensus on the level of impact (Set 4) or uncertainty (Set 5). These drivers represent issues that while of concern to some, may not be at dominant in today's industry agenda (weak signals), or for which there is less industry consensus.

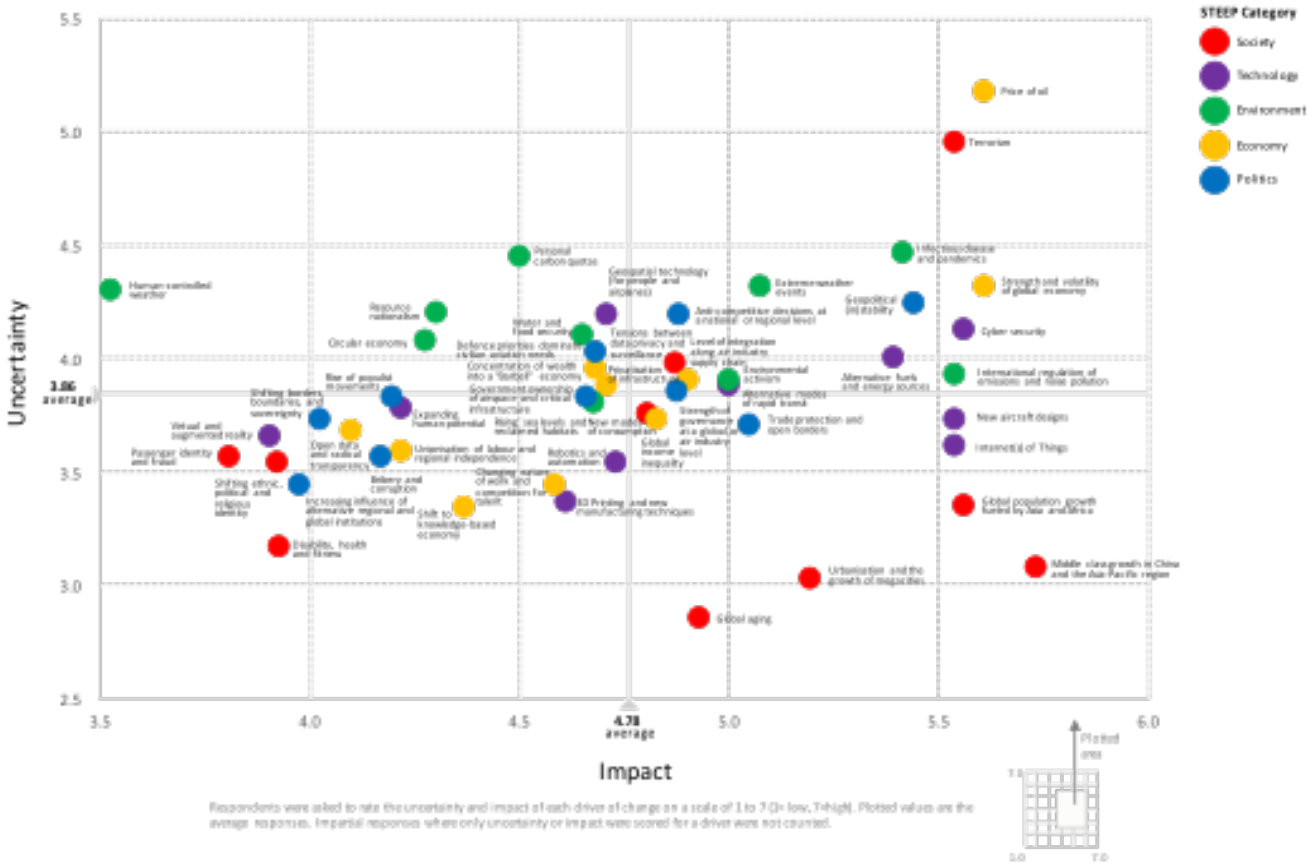


Figure 5: Prioritization of the Drivers of Change by their Impact and Uncertainty

Set 1. Prioritized drivers (Greater than average impact and uncertainty)

- Alternative fuels and energy sources
- Cybersecurity
- Environmental activism
- Extreme weather events
- Geopolitical (in)stability
- Infectious disease and pandemics
- International regulation of emissions and noise pollution
- Level of Integration along air-industry supply chain
- New modes of consumption
- Price of oil
- Strength and volatility of the global economy
- Tensions between data privacy and surveillance
- Terrorism

Set 2. Highest rated drivers based on impact on the sector

- Middle class growth in China and the Asia-Pacific region
- Strength and volatility of global economy
- Price of oil
- Global population growth fueled by Asia and Africa
- Cybersecurity
- Terrorism
- Internet(s) of Things
- New aircraft designs
- International regulation of emissions and noise pollution
- Geopolitical (in)stability

Set 3. Highest rated drivers based on the uncertainty of the impact

- Price of oil
- Terrorism
- Infectious disease and pandemics
- Personal carbon quotas
- Strength and volatility of global economy
- Extreme weather events
- Human-controlled weather
- Geopolitical (in)stability
- Resource nationalism
- Geospatial technology
- Anti-competitive decisions

Set 4. Greatest variance in impact

- Price of oil
- Terrorism
- Infectious disease and pandemics
- Personal carbon quotas
- Strength and volatility of global economy
- Extreme weather events
- Human-controlled weather
- Geopolitical (in)stability
- Resource nationalism
- Geospatial technology
- Anti-competitive decisions

Set 5. Greatest variance in uncertainty

- Alternative modes of rapid transit
- Extreme weather events
- Human-controlled weather
- Internet(s) of Things
- Global population growth fueled by Asia and Africa
- Rising sea levels and reclaimed habitats
- International regulation of emissions and noise pollution
- Infectious disease and pandemics
- Geospatial technology
- Alternative fuels and energy sources

Annex C – Scenario Characteristics

Theme	NEW FRONTIERS (Turbulent world / Connected and open data)	Sustainable Future (Calm world / Connected and open data)	Platforms (Calm World / Closed data)	Resource Wars (Turbulent world / Closed data)
Geopolitics	Rise of alternative institutions as shift of power to East and challenge to US. China becomes a champion for sustainability, sharing expertise and helping developing countries develop their infrastructure in return for influence. Space, the Arctic and oceans are the new conflict zones.	Thirty years of peace, although borders have been redrawn. A more multipolar world in which Egypt, Iran, Nigeria, Pakistan and South Korea join the G20 in the wake of a Chinese Debt crisis. Strong international governance enables long-term and cooperative infrastructure decisions.	China takes leadership role on global stage, cooperating with US. G2 world with corporations increasingly influential on global stage. China is the strongest world-trade hub with Latin America, India and Middle East playing an increasing role.	An aggressive, nationalistic China emerges and threatens a US distracted by conflict. Meanwhile the Middle East and Asia have seen a wave of territorial disputes and land grabs. The world has realigned into resource trading blocs.
Data	General shift towards democratization of data, empowering people, companies and organizations. Increased risks of transnational cybercrime. Police state/surveillance. New technologies and data help reduce gridlock and address challenges in major cities.	Open access to information, with shared platforms. Big data, predictive analytics and AI allow rapid forecasting of intentions and behavior. People are paid for their data. Supervision and surveillance at work. Drive to harmonize international standards. Entrepreneurship and non-traditional careers.	Data is siloed with a few big corporations controlling data platforms/access to technology – while public are wary of sharing information with other companies. Advances have disproportionately benefited the elite, widespread inequality.	Cyber security and espionage have resulted in distrust both between countries and corporations. The Internet of Everything has not been realized. Countries and companies increasingly compete for access to skilled and technical expertise.
Africa and Asia-Pacific	China prioritizes relationships within Asia-Pacific, offering investment in return for resources. Iran comes back into the fold as a regional power in the Middle East.	Africa and Asia-Pacific experience rapid growth, using new technologies to address key challenges around water, environment and education.	Africa and Latin America prioritized international trade over regional integration and are hit hard when commodity prices collapse. Middle East economies realign based on new interests in a post-oil economy.	India emerges as the fastest-growing economy in 2035, having successfully managed its demographic transition and invested in infrastructure and water technologies.

Theme	NEW FRONTIERS (Turbulent world / Connected and open data)	Sustainable Future (Calm world / Connected and open data)	Platforms (Calm World / Closed data)	Resource Wars (Turbulent world / Closed data)
Government	Data-driven government and political experimentation. In most countries people give up control of data in return for convenience – a new 'social contract' based on data.	Governments leverage opportunities associated with open data and open democracy. Authorities oversee implementation of solutions at a local level, but deliver through outsourced provision to companies and communities.	Disempowered public are increasingly dissatisfied with political elite. New sensor and surveillance tools used to monitor and limit	Increased authoritarianism as governments enforce restrictive policies. Growing shadow economy as governments fail to capitalize on promise of new surveillance and big data technologies.
Security and borders	New forms of terrorism with greater access and 'homemade' security threats. Increased restrictions on movement across borders except for 'biometric' citizens. Military needs take precedence over those of civilians.	Open skies and borders with increased demand for travel from Asia-Pacific and Africa. New visas and travel restrictions limit travel as part of the Climate Resettlement Initiative	Borders open, although disease concerns require all travelers to be continuously monitored during travel. People move fast, limiting exposure to unknown people or places.	Gaps widen between resource-rich and poor regions, and security and border checks are used to limit movement between regions. Physical security is increasingly important due to virtual identity theft.
Privacy and trust	People 'shift to passive', giving up control of data in return for convenience, economic benefit and security. Virtual and physical boundaries blur. States sense and control all aspects of society.	Trust is transient with organizations required to publish data on all aspects of performance from staff mental health to energy trades.	People are wary of sharing their data following a series of high profile data breaches and cyber attacks. Trust is low, but people are locked in to data platforms.	Regional instability and conflict, coupled with a failure to sort out slums has encouraged trade in illicit goods, human beings, robots, and increased violence and organized crime. Public distrustful of institutions due to fear and corruption.

Theme	NEW FRONTIERS (Turbulent world / Connected and open data)	Sustainable Future (Calm world / Connected and open data)	Platforms (Calm World / Closed data)	Resource Wars (Turbulent world / Closed data)
Business models	Elimination of traditional supply chains. Shipping of materials rather than finished products, with production at or near the point of use. Businesses focus on customer service.	Businesses and governments are data-driven. Holding and sharing more and more data, combined with predictive analytics and AI to forecast customer behavior. Grand challenges have evolved into precision challenges.	Companies seek to control data as the platform of choice, acting to preempt external challengers and seek a first-mover advantage over competitors.	Small, nimble companies fight to occupy niches –organizations are stripped back to bare bones as they look to become zero-waste to reduce reliance on foreign nations. Rise of the circular economy.
Economy	Series of financial crises and austerity. Cities are the unit of power. Oil prices are high. Policy changes in advanced economies encourage older workers to stay in the workforce longer, while making it easier for women and part-time workers to stay employed.	Calm world and a stable economy allows increased trade – new trade routes between South-South and East. Blockchain and other new technologies have reformed financial and legal sector, reducing friction in economy and bypassing traditional banks.	Strong GDP growth, having addressed structural issues of 2000s. Economy no longer dominated by oil – data is the new if inequitable currency.	Economic growth stalls. Companies have limited access to capital, and both private and public sectors fail to invest in infrastructure and innovation. Economies increasingly turn inward.
Values and Communities	Strong national cohesion and increased multiculturalism. Growing population with more people traveling (and demanding to travel). New challenges and stresses on healthcare and infrastructure.	Communities are empowered to influence politics and development. These communities increasingly transcend traditional geographies, often driven by the diaspora communities established by the Climate Resettlement Initiative.	Society is community-centric. Elites desire authentic and personalized experiences. Those who can afford it are living longer, faster, better, while pandemics and poverty are rife in hive cities and slums.	Growing diversity is an increased source of tension among communities – who are unwilling to compromise on values as consumers. In many countries Generation Alpha are ready to embrace a less materialistic life. Multiculturalism.

Theme	NEW FRONTIERS (Turbulent world / Connected and open data)	Sustainable Future (Calm world / Connected and open data)	Platforms (Calm World / Closed data)	Resource Wars (Turbulent world / Closed data)
Environment	Large numbers of displaced communities due to sea-level increases. Oil continues to predominate energy mix – though many countries will be more than 80% reliant on renewables and nuclear by 2050.	Rapid innovation helps people meet sustainability targets. Global approach to addressing climate change combines new technologies with new data platforms to solve social challenges and combat cyber-crime.	Too little too late. Poor decisions led to failure to meet global sustainability targets. Many nations introduce personal market-based incentives, but the World Cabinet fails to legislate meaningful targets for businesses.	The environment has not been prioritized, but there is growing realism about climate change's existential threat to humanity. Limited resources have led to the rise of the 'circular economy'.
Technology	Sharing economy models are dominant, while 3D printing has disrupted manufacturing.	People and goods increasingly move point-to-point over short distances using drones. Blockchain technologies have reformed access to finance and legal support. Real-time monitoring of physical and human performance.	Advances in neuro and biotechnology and healthcare. But inequality in access.	Robotics and Artificial Intelligence have altered the nature of work. Service robotics, health robotics and policing are ubiquitous.

Annex D – List of Recommendations

1. Geopolitics

1.1 GEOPOLITICAL TRANSITIONS AND REALIGNMENT

Recommendation 1: IATA should continue to support global standards bodies such as ICAO, and think strategically about how the relationship between IATA and these institutions will evolve. It will be important to maintain global standards for a global industry, especially in futures that are increasingly multipolar or where there are shifts in the balance of power.

Recommendation 2: IATA should engage early with new institutions (such as the New Development Bank) in order to play a more significant role in enacting or influencing aviation policy in the top markets in 2035 (China, US, India, UK, EU and Indonesia).

1.2 PEACE AND SECURITY

Recommendation 3: IATA should advocate for greater flexibility in routing and scheduling that might allow airlines to deal wiht implications of capacity issues caused by conflicts and other major disruptions.

Recommendation 4: IATA should develop an "emergency response" set of guidelines and procedures that could be implemented rapidly by airlines if the security situation becomes more turbulent. These may include passenger screening, data sharing and security procedures.

2. Africa and Asia-Pacific

2.1 NEW MARKETS

Recommendation 5: I IATA should increase its engagement with stakeholders from Africa and Asia-Pacfic (governments, think-tanks and other bodies that influence government policy) to deepen the industry's knowledge of how decisions are made and how those decision-making processes will evolve. This will ensure that regulations introduced do not limit the potential of these markets. .

2.3 HUBS AND SMALLER AIRPORTS

Recommendation 6: IATA should foster relationships with secondary and tertiary airports. These may offer additional capacity in situations where hubs become overcrowded, or where new technologies, automation and business models allow airlines to bypass hubs and establish new intermodal connections (e.g. Uber-type business models).

3.3. Security and borders

3.2 INFECTIOUS DISEASES

Recommendation 7: With the increasing risk of pandemics, a global approach to managing infectious diseases becomes ever more important. While airlines need to be vigilant and prepared, IATA should also stress the increasingly important role that all stakeholders, particularly governments, need to play to ensure that responses are in line with WHO guidance and international health regulations.

3.4 BIOHACKING

Recommendation 8: IATA should work with appropriate organizations to drive the establishment of globally harmonized standards to address biohacking.

4. Environment

4.1 SUSTAINABILITY LEADERSHIP

Recommendation 9: IATA should continue to support the industry's efforts on environmental sustainability and re-evaluate, on an ongoing basis, its activities in this area. Environmental performance is one of the key elements of society's changing expectations of aviation and an element which becomes increasingly critical in a resource-constrained world. But sustainability isn't environmental alone, and countries' expectations of airlines will move beyond the environmental sphere. In that vein, IATA should explore other ways in which the industry has or can have a positive influence in the world, potentially linking these to the UN Sustainable Development Goals 2030.

Recommendation 10: IATA should establish an industry-wide corporate responsibility programme, with a focus on transparency, safety and the environment that could help IATA to drive global standards and ensure the sector remains competitive in a world where there is increasing competition from other transport modalities.

5. Economy

5.1 GLOBAL ECONOMY

Recommendation 11: IATA should create an internal early warning group with the task of ensuring that the industry is prepared for possible threats. This group could distill a set of early warning indicators from this scenario report and similar publications, create a timeline of expected developments, and update it regularly.

5.3 WORKFORCE AND SKILLS

Recommendation 12: IATA should develop a plan for educating and influencing the next generation of airline industry employees and users (e.g. 15-25 year olds). As new technologies and value shifts change how and why people work, the industry will need to invest in skills for future aviation leaders and workers, and communicate the benefits of working in the sector.

6. Data

6.1 DEATH OR REBIRTH

Recommendation 13: IATA should consider measures that support airline ownership of data (e.g. safeguarding privacy, commitment to common data protection procedures), and look to establish a global industry-wide position on data protection. A more open approach to data and interoperability at a global and industry level may be more positive for the industry and for consumers.

6.3 SUPPLY AND FLOW

Recommendation 14: IATA is already in the process of exploring how to take advantage (and manage risks) of new technologies such as blockchain. We suggest also looking at the effect this and other new technologies can have on the business relationships on its member airlines. Can blockchain play a role, for example, in rebalancing the value chain?

7. Privacy and trust

7.1 TERRORISM

Recommendation 15: The industry should monitor proposals to extend or evolve the security cordon around airports to ensure that governments continue to be ultimately responsible for the safety of their citizens.

7.2 CYBERSECURITY

Recommendation 16: IATA should consider establishing an information exchange mechanism for airlines to share information on cybersecurity threats (as part of a cybersecurity strategy). Cybersecurity is likely to be a major issue that will require the industry to work with companies across the entire supply chain, as well as governments to manage risk.

8. Technology

8.1 SHARING AND POST-SHARING

Recommendation 17: IATA should engage with novel transport providers (hyperloop, drones, unmanned aircraft, space travel companies) to explore potential cooperation as well as shared needs. In a future where passengers want to travel faster and prioritize convenience, seamless travel and connections between providers will become increasingly important. One option may be to widen IATA membership to include air transport operators who are not airlines.

8.2 AUTOMATION OF PLANES

Recommendation 18: Automation is expected to have a significant impact on transportation and logistics. To ensure that the airline industry benefits, IATA should establish a working group including both manned and unmanned aircraft operators to facilitate standard-setting and information sharing.

8.4 AIRPORTS OF THE FUTURE

Recommendation 19: IATA should build relationships with those responsible for urban planning (not just air infrastructure authorities) to ensure industry needs are linked into infrastructure planning, particularly when there are major plans for developments around airports.

Recommendation 20: IATA should use the strategic review of the Worldwide Slots Guidance as one mechanism to improve the efficienct use of capacity and guard against revenue commitment and market allocation of slots.

9. Values and Communities

9.3 PASSENGER CARE

Recommendation 21: IATA should establish core principles on facilitating the travel of older passengers and those with reduced mobility. An increasingly active aging population and changing attitudes to disability are likely to result in a greater need for the industry to support passengers with special requirements, for example on account of age, medical need or disability.

10. Government

10.1 INFRASTRUCTURE

Recommendation 22: IATA should keep an eye out for aviation funds being diverted to 'new frontiers' (such as space travel). It could also prepare a list of infrastructure issues on which the sector may need to advocate in the future. Where regions have insufficient state finance or commitment to the sector, it may be necessary to look at alternative funding models.

11. Business models

11.2 CATERING FOR NEW CUSTOMERS

Recommendation 23: IATA should make every effort to understand consumer attitudes in emerging markets, as well as how government and business in these countries view the role of the airline industry, in order to get ahead of potential future regulation.

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