

White Paper

Digital Transformation Initiative

Aviation, Travel and Tourism Industry

In Collaboration with Accenture

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The Digital Transformation Initiative

The Digital Transformation Initiative (DTI) is a project launched by the World Economic Forum in 2015 as part of the System Initiative on Shaping the Future of Digital Economy and Society. It is an ongoing initiative that serves as the focal point at the Forum for new opportunities and themes arising from latest developments in the digitalization of business and society. It supports the Forum's broader activity around the theme of the Fourth Industrial Revolution.

To find out more about the DTI project, visit <http://reports.weforum.org/digital-transformation>

Foreword

There is widespread recognition among industry leaders that the role of digital technology is rapidly shifting, from being a driver of marginal efficiency to an enabler of fundamental innovation and disruption. Digitalization is the cause of large-scale and sweeping transformations across multiple aspects of business, providing unparalleled opportunities for value creation and capture, while also representing a major source of risk. Business leaders across all sectors are grappling with the strategic implications of these transformations for their organizations, industry ecosystems and society. The economic and societal implications of digitalization are contested and raising serious questions about the wider impact of digital transformation.

Digital technology is transforming most industries and creating new challenges that need to be understood. These include factors such as the pace of change, cultural transformation, outdated regulation, identifying the skills needed for the future, overcoming shortcomings in legacy systems, and the need to fund both digital and physical infrastructure. These challenges need to be addressed by industry and government leaders to unlock the substantial benefits digital offers society and industry.

Launched in 2015, the World Economic Forum's Digital Transformation Initiative (DTI) is an ongoing project within the System Initiative on Shaping the Future of Digital Economy and Society, serving as the focal point for new opportunities and themes arising from latest developments in the digitalization of business and society. It supports the Forum's broader activity around the theme of the Fourth Industrial Revolution.

A key component of the DTI project in 2016 has been the quantification of the value at stake from digitalization for both business and society over the next decade across various industries including aviation, travel and tourism. Digitalization is one of the most fundamental drivers of change today, presenting a unique chance to shape the future. The World Economic Forum is committed to helping leaders understand these implications and supporting them on the journey to shape better opportunities for business and society.

Following an initial deep-dive of six industries in 2015, DTI has focused in 2016 on the impact of digital transformation on an additional seven industries including the aviation, travel and tourism industry. This year, the Forum also examined several cross-industry topics, including platform economy, and societal value and policy imperatives. Through its broad focus, DTI has driven engagement on some of the most pressing topics facing industries and businesses today and provided business and policy leaders with an informed perspective on how to take action.

This white paper on aviation, travel and tourism was prepared in collaboration with Accenture, whom we would like to thank for their support. We would also like to thank the working group members, as well as the more than 40 experts from business, government and academia, and all the Industry Partners who were involved in shaping the insights and recommendations of this project.

We are confident that the findings will contribute to improving the state of the world through digital transformation, both for business and society.



Bruce Weinelt
Head of Digital Transformation
World Economic Forum



John Moavenzadeh
Head of Mobility Industries and Systems Initiatives
World Economic Forum

Executive Summary

A digital trailblazer, but more disruption ahead

The aviation, travel and tourism industry has been at the forefront of digital disruption, changing the way people travel. Nonetheless, World Economic Forum research suggests it should brace itself for another wave of digital transformation.

There are a series of industry, customer and technology trends converging to redefine operating and business models in the travel ecosystem. New entrants – especially digital natives such as online travel aggregators (OTAs), meta-search engines and travel service platforms – are shaking up the value chain. Growing demand for travel, particularly in emerging markets, represents a significant opportunity for these new entrants, as they challenge incumbent businesses to rapidly adapt their own strategies to capture growth. Travel providers are seeking stronger interactions with customers, while drastically changing operations, in pursuit of better insights around customer preferences and operational performance. Connected devices and artificial intelligence (AI) will provide ample opportunities to make those operations more effective, and enable collaboration and asset-sharing between enterprises. Technology will also have an impact on the industry workforce, with employees empowered by real-time information and decision-making support from AI to focus on their core strengths.

Digital themes

These trends look set to propel the industry into a period of accelerated digitalization. Four themes have been identified that will take centre stage in shaping travel and tourism over the next decade:



Living travel experience

Travellers will experience seamless journeys tailored to their habits and preferences. Companies along the Aviation, Travel and Tourism industry journey will optimize customer experience by collecting and exchanging data, and continuously generating insights. In time, travel will become frictionless, blending seamlessly with other everyday activities.



Enabling the travel ecosystem

Ecosystem roles are blurring as stakeholders throughout the customer journey vie to own the customer relationship. Digital platforms that enable ecosystem alliances will continue to emerge, as asset and information sharing become increasingly important from a B2B perspective.



Digital enterprise

Digital technologies that revolutionize manufacturing, optimize the real-time use of assets and eventually augment the industry workforce will transform operations. Innovations such as 3D printing, AI, the Internet of Things (IoT), virtual reality (VR) and digital platforms will enable flexible working and changes to core operational processes.



Safety and security

As identity management becomes increasingly digital, a collaborative effort towards boosting cybersecurity and protecting the privacy of traveller data will be crucial to maintaining customer trust and public safety. Digital technologies (e.g. biometrics such as facial recognition, IoT, crowd analytics and video monitoring via AI) will be used to create a ubiquitously secure environment.

Calculating the value of digital transformation

The Forum's value-at-stake analysis aims to assess the value unlocked by digital transformation initiatives within the four themes across the entire ecosystem. (For an explanation of the value-at-stake methodology, see Section 4 of this report, Value Framework.)

Over the next decade (2016 to 2025), digitalization in aviation, travel and tourism is expected to:

- Create up to \$305 billion of value for the industry through increased profitability
- Migrate \$100 billion of value from traditional players to new competitors
- Generate benefits valued at \$700 billion for customers and wider society through a reduced environmental footprint, improved safety and security, and cost and time savings for consumers
- Result in a net displacement of current jobs in the industry, which is expected to be partially offset by the creation of next-generation skilled jobs inside and outside the travel ecosystem

Digitalization should have a positive environmental impact, contributing to a more sustainable industry footprint through innovations in manufacturing, smart assets and efficient resource use. For customers, the personal impact is expected to be significant as travel becomes a seamless, frictionless, higher-quality experience.

The greatest societal impact may be the effect of digital transformation on the travel workforce, which could represent as many as one in every 11 jobs worldwide by 2025. Intelligent automation will change the nature of some travel jobs and eradicate others altogether. However, digitally enabled growth will also generate new employment opportunities that could outpace the automation of existing roles, especially as strong growth is forecast for the industry. Platforms also enable "liquid", flexible workforce models, which will redefine the employer-employee relationship and present new challenges for regulating the workforce. A concerted effort across industry, government, educational institutions and civil society will be required to mitigate any negative impacts.

Key questions

As the digitalization of aviation, travel and tourism accelerates, stakeholders within the industry will need to consider important questions about the future evolution of the travel ecosystem, including:

- How can the travel ecosystem incentivize customers to share personal data in exchange for tangible benefits, such as a hyper-personalized travel experience, while ensuring that a consumer's right to privacy is protected?
- Is there a model for forging global collaboration and facilitating the sharing of company assets, to unleash the full potential of digital transformation, while also preserving a company's relevance in the battle for consumer mindshare?

- How will the operating models of travel organizations change in a smart and connected world where the lines between online and offline are blurring, and physical assets are becoming digital? How will this change the behaviour of individuals?
- To what degree can personal data be securely and ethically used, and made interoperable across public and private stakeholders, to boost safety and security?

Key points to consider

Maximizing the value of digitalization in aviation, travel and tourism will require concerted action from industry leaders, regulators and policy-makers. A series of actions for ecosystem participants looking to make digital transformation a success has been identified:

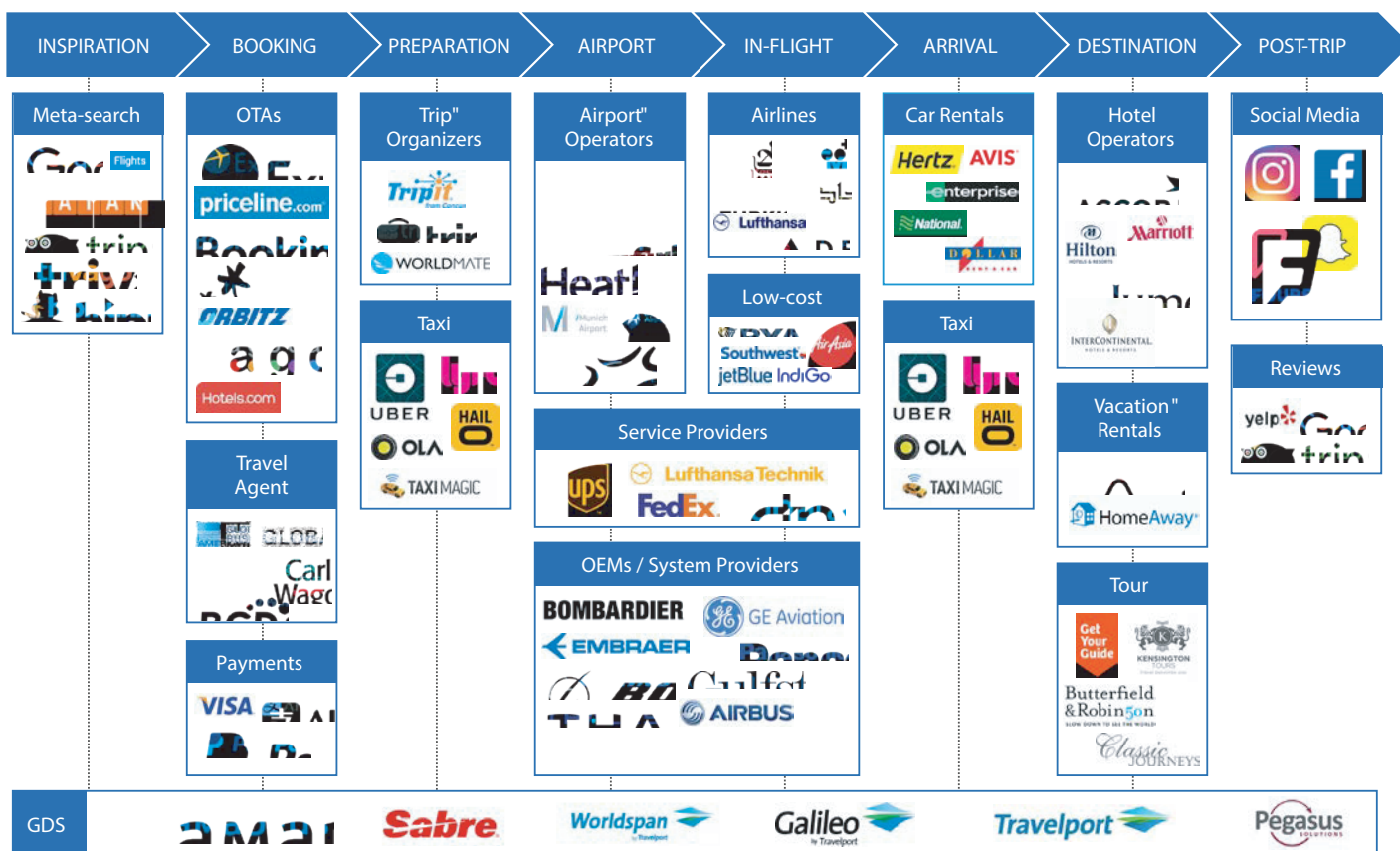
- To what degree can personal data be securely and ethically used, and made interoperable across public and private stakeholders, to boost safety and security?
- Support the transition of the workforce by reskilling current employees through training, and empower educational institutions to design curricula that prepare the next generation for the digital economy.
- Develop a multistakeholder approach – involving private, public and civil-society organizations – to deliver regulatory frameworks that define the appropriate uses of data.

Industry Context and Digital Trends

The aviation, travel and tourism industry has been at the forefront of digital innovation, but industry and technology trends suggest that further change lies ahead. The sector has been an early adopter of digital technologies and platforms, but steep demand for travel, driven by a growing middle class in emerging markets and the increasing importance of digital experiences, implies that further digitalization will be vital if the expectations of tomorrow's consumers are to be met.

The travel ecosystem (see Figure 1) has helped shape customer expectations for on-demand and convenient services through digital innovation, both within and across industry boundaries. The next step is for organizations that are lagging behind to change how they work, so that they too can capture the opportunities that digital transformation presents.

Figure 1: The Aviation, Travel and Tourism Ecosystem



Source: World Economic Forum/Accenture analysis

The transformation is encapsulated in a macro trend: from the traditional economy to the new economy, i.e. from manufacturing to services. Digital is one of the developments that enables companies to offer services instead of products. As an industry, aviation, travel and tourism has a head start, because of its position as a heavily service oriented ecosystem at the "new economy" end of the spectrum.

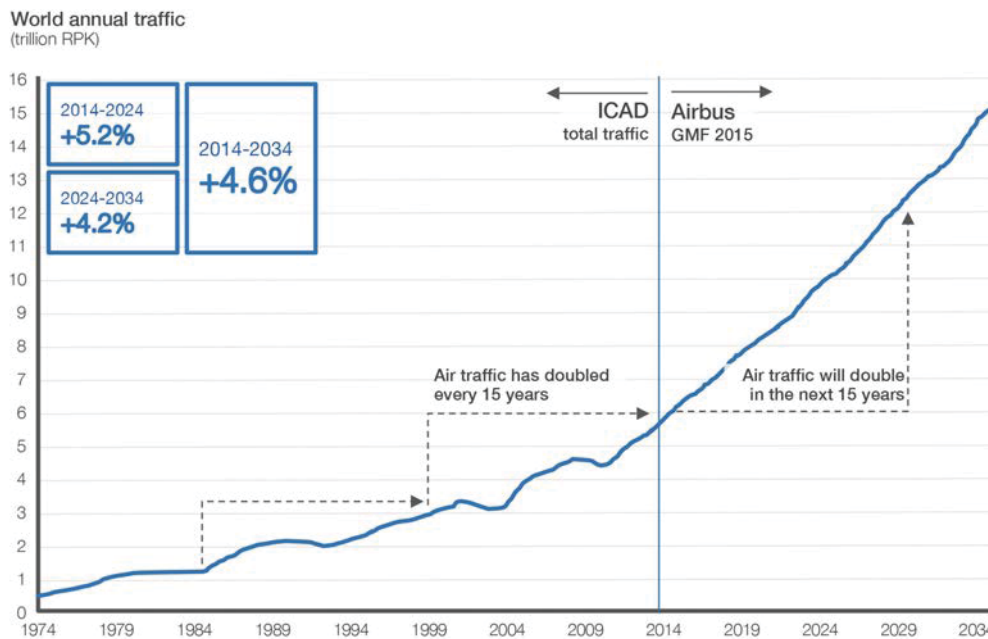
Industry trends

- 1. Growing demand for travel** - Growing demand brings a great opportunity, while challenging ecosystem stakeholders to rapidly adapt their strategies to capture growth. Since the 1980s, the amount of air traffic has doubled every 15 years, and is expected to continue to do so (see Figure 2).

70% Forecast share of global airline travel that emerging markets will account for by 2034.

Appetite for travel is increasing due to demographic developments: the growing influence of millennials, who are more likely to travel; and the expected doubling of the middle class in high-growth global regions, and the corresponding rise in their disposable income. 2 Furthermore, travel itself has become more affordable, with global airline fares falling in price by 4% in the first quarter of 2016 compared to a year earlier.

Figure 2: Aviation Traffic Forecast to Double in the Next 15 years (revenue passenger kilometre, trillion)



Source: ICAO, Airbus GMF 2015

- 2. The rise of the digital consumer** - The travel industry is a leader in e-commerce maturity. Without owning high-capital assets (e.g. cars, planes or accommodation), new entrants such as online travel agencies (OTA), meta-search engines and booking platforms are harnessing technological developments to build digital platforms that aggressively disrupt the value chain. These new entrants challenge the aviation, travel and tourism incumbents, while the incumbents try to adapt to the new digital paradigm – and attempt to gain direct access to the “digital customer” and own that relationship.

37% Percentage of airline travellers with an online presence in 2014, compared to a global average of 6.5% for other industries. 4

- 3. Changes to the security landscape** - Geopolitical tensions, terrorist activity and some high-profile accidents have brought a renewed focus on security and safety. Beyond their direct human cost, attacks and accidents can also have significant economic fallout, as the example below illustrates. As security measures tighten, an impact on the overall demand for travel can be expected. The question for stakeholders is how to support growing demand for travel seamlessly, while also maintaining and improving security standards. Security concerns are relevant to both physical environments (e.g. border checkpoints and within tourist zones) and the digital world (e.g. data privacy). Security breaches (in the physical or digital world) and accidents can inflict severe financial and reputational damage on travel companies

Implications

Industry

Digital transformation will lead to a reduction in process driven, low-skilled physical and administrative jobs (e.g. housekeeping, check-in staff and flight attendants). On the other hand, new types of jobs will emerge, e.g. roles focused on boosting online engagement with customers. Those without advanced skills can be empowered by technology to perform more complex tasks. Training programmes to reskill employees will be critical to preparing the industry's workforce for the changes ahead. Collaboration and data-sharing within the industry ecosystem will become more important and play a vital role in supporting initiatives that improve demand forecasting and asset optimization. As this data could be commercially sensitive, stakeholders might be hesitant to collaborate. Successful collaboration between ecosystem players will, however, bring huge benefits for both the industry itself and wider society (e.g. fewer emissions, reduced aircraft noise, cost savings), so regulators and governments should encourage the industry to create data-sharing platforms. Joint efforts will also be required between government and industry to boost cybersecurity and fight off large-scale cyber-threats.

Government

Experts interviewed differed in their opinion on how the initiatives in this theme would affect employment numbers. Some argued that there would be no significant impact; others predicted that the number of jobs in the industry will decline. The nature of work in aviation, travel and tourism, as in other industries, is also likely to change, driven by developments such as the emergence of the sharing economy. Although there is evidence to suggest that younger generations enjoy the work-life balance that on-demand employment models can provide, governments will need to mitigate the lack of a safety net attached to these more flexible working arrangements.³⁵ As digitalization becomes more entrenched, government and other stakeholders will need to support the transition to new ways of working. Interviewees agreed that new skills will be required and educational institutions will need to design curricula that adequately train the next generation of workers in the travel industry to be able to work collaboratively with intelligent technologies.

Civil society

On the surface, the initiatives in this theme look wholly positive for customers: faster, more efficient, higher-quality travel services. Yet the innovations underpinning these improvements leave many people feeling uneasy. Around 25% of respondents to a recent survey said they felt uncomfortable about the future role that robots will have in the travel industry. They cited worries that robots would be too impersonal, insensitive to cultural changes, lack creativity, and eventually would make people lazy.

Key questions

- What impact might the decentralization of supply chains, driven by the introduction of on-demand 3D printing, have on the aviation, travel and tourism ecosystem? Could more affordable, localized production bring jobs back to the developed world?
- How can industry leaders and policy-makers ensure the right skills are in place to build the workforce of the future?

The European Commission has been proactive in its efforts to solve some of these questions. The EC ran the “Grand Coalition for Digital Jobs” project between 2013 and 2016. Building on the positive results from that project, the “Digital Skills and Jobs Coalition” effort has since been launched. As a part of this programme, member states are invited to develop comprehensive national digital skills strategies by mid-2017 based on targets set by the end of 2016. These include:

- Establishing national digital skills coalitions connecting public authorities, business, education, training and labour market stakeholders.
- Developing concrete measures to bring digital skills and competences to all levels of education and training, supporting teachers and educators and promoting active involvement of business and other organizations.

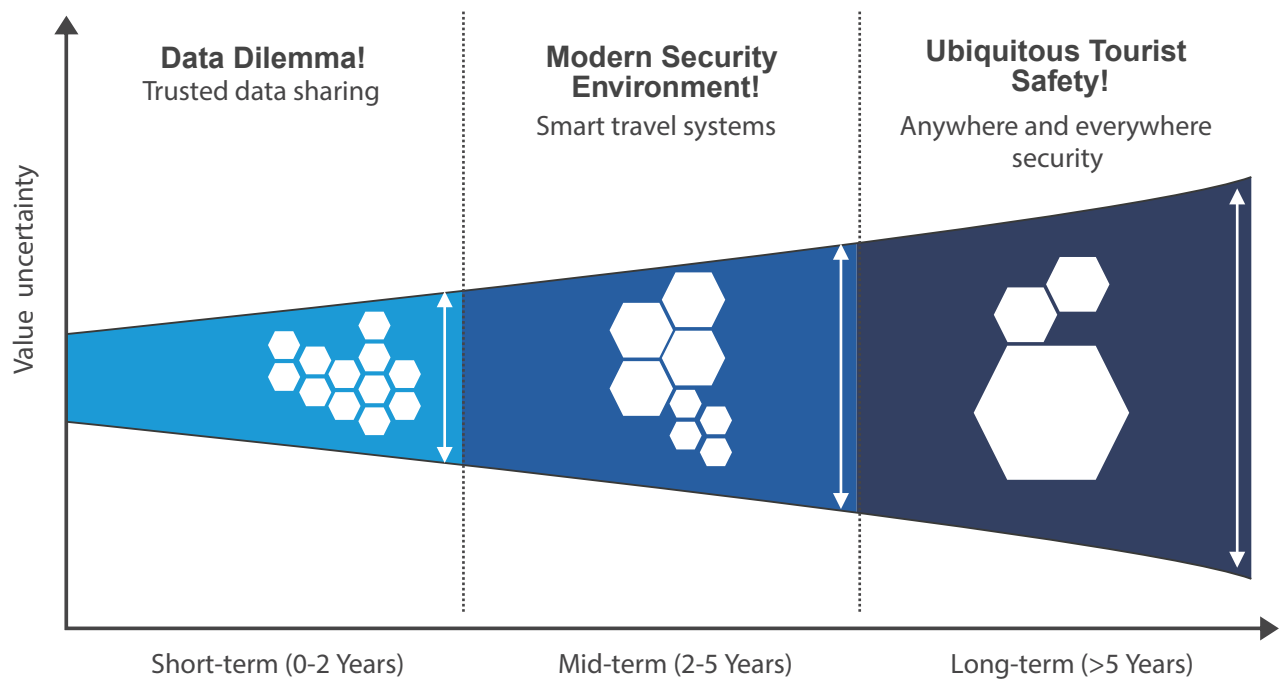
Safety and security

As safety and security evolve across physical and digital spaces, data sharing, interoperable security systems and law-enforcement cooperation on a global scale will become increasingly important.



Safety and security are among the top priorities for aviation, travel and tourism, especially at a time of increasing geopolitical instability. However, these priorities should not be an argument to avoid change or stop innovating. Ways must be found to allow innovations that enhance safety. With demand for travel predicted to grow, security processes will also need to adapt to handle a higher number of passengers in the future. Technology has an important role to play in this evolution by contributing to seamless security processes that maximize effectiveness while minimizing interference in a traveller's journey. As a result, safety and security is expected to evolve across both the physical and digital worlds (see Figure 10).

Figure 10: Evolution of Safety and Security



- **Data dilemma** - In the short term (next two years), visa processes will be streamlined thanks to digital data management. New measures will remove the need for physical checkpoints such as passport control at airports. Instead, emerging digital technologies (e.g. biometrics such as facial recognition, IoT, crowd analytics and video monitoring via AI) will be used to create a ubiquitously secure environment. In short, a compromise on personal privacy will improve security and the overall travel experience. To achieve this, industry and governments must align themselves on data security and agree on how to share responsibilities.
- **Modern security environment** - In the midterm (between two and five years), national borders will blur as they already have within the European Union, even though the trend of governments is to be more cautious in the face of geopolitical instability and a challenging security environment. A single global travel security framework could enhance law-enforcement cooperation and enable an interoperable identity authentication system connected to a global database for all travellers.
- **Ubiquitous tourist safety** - In the long term (five years and beyond), security checkpoints will not be an integral part of travel as it merges with daily life, and security will become seamlessly integrated. Travellers will be monitored by authorities who collaborate via a single global system. Eligibility for travel comes from a global secure traveller programme, which relies on advanced data analytics, background checks and data sharing.

Data Dilemma



Security around data is too significant to be left uncertain. Clear responsibilities are needed.



Timothy Noonan, Director, International Trade Union Confederation (ITUC), Belgium

The extent to which customers are prepared to trade their privacy for more security (and other potential benefits) will determine how everyday security will evolve. Where customers are willing to share their data, it is easier for authorities to increase their security. For example, when everyone’s identity is shared by their smartphone, anyone that does not share this information could be deemed suspicious. But this information could also be used to harm individuals if it ends up being accessed by the wrong people (e.g. identity thieves).

One solution is a central coordinated data opt-in system, in which travellers can decide to whom their information is available and for what length of time (e.g. with local authorities, a hotel and insurance company but only for the duration of an overseas trip, before it is encrypted again). To make this system work, clear boundaries would need to be set around the role of governments and enterprises in the governance of data (i.e. who owns it, who uses it and who protects it).

Case Study: Transport for London – Creating a Rich Open-Data Source

Transport for London (TfL) is committed to syndicating open data to third parties (wherever technically, commercially and legally viable) and to engaging developers to deliver and innovate high-quality travel apps, tools and services using open data. TfL data now powers around 500 travel apps, with more than 42% of Londoners using at least one app built with TfL data.

Modern security environment



Some airlines have built their own security teams to supplement airport security and enhance information sharing between parties.



Steve Singh, Chief Executive Officer, Concur Technologies, USA

Security in restricted areas, such as aircraft or airports, is currently managed using strict checkpoints. This approach can lead to long waiting lines, low customer satisfaction and, because of the high dependence on human skills, mistakes being made. The modern security environment will improve security and should make these problems a thing of the past. Screening technology such as biometrics, full-body scanners, multi-view X-rays and automated target recognition will improve the efficiency and effectiveness of security checks. At the same time, interference in the experience of travellers needs to be minimized. This requires a more data-rich and risk-based approach, utilizing technology, increased collaboration and standardization.

Security in travel

The issue of security in travel was identified by the chief executives of the World Economic Forum's Aviation, Travel and Tourism Industry community as a top priority. The aviation, travel and tourism industry plays a key role in generating economic growth, creating jobs and enabling integration, but today, governments are tending to be more cautious in the face of geopolitical instability and a challenging security environment. The world cannot rely on today's system to ensure a seamless and secure travel environment in the future. A new framework for the future of travel must be designed. Research was undertaken at the World Economic Forum to understand the link between data security, technology and privacy – and their implications. Based on the initial research, the primary recommendations for an improved security environment are:

- Data analytics and biometrics-driven improvements in visa processes
- Smarter security at border crossings
- Cooperation and standardization with a global framework
- Shifting from country-of-origin-based assessment to a global secure traveller programme

The Forum believes that there is a need for deeper analysis of what a global trusted traveller programme could look like, and has been developing a framework for such a programme, taking into consideration the legal, political and economic ramifications; issues around data sharing, collaboration and privacy; and the feasibility and cost.

Case Study: Aruba Happy Flow – Applying Facial Recognition to Security Clearance

Aruba Happy Flow is an innovative scheme that requires passengers to only show their passport once on each journey. Facial recognition is the primary means of identifying passengers and is used throughout the airport to help the passenger check in, drop off baggage, pass through border controls and board the aircraft. Clearing each checkpoint takes seconds. Stakeholders including the governments of Aruba and the Netherlands, Schiphol Group, KLM and Aruba Airport Security have all helped realize this innovation in security clearance. Future goals for the initiative include making pre-clearance for the EU a reality and rolling out the initiative at Amsterdam's Schiphol Airport.

Ubiquitous tourist safety

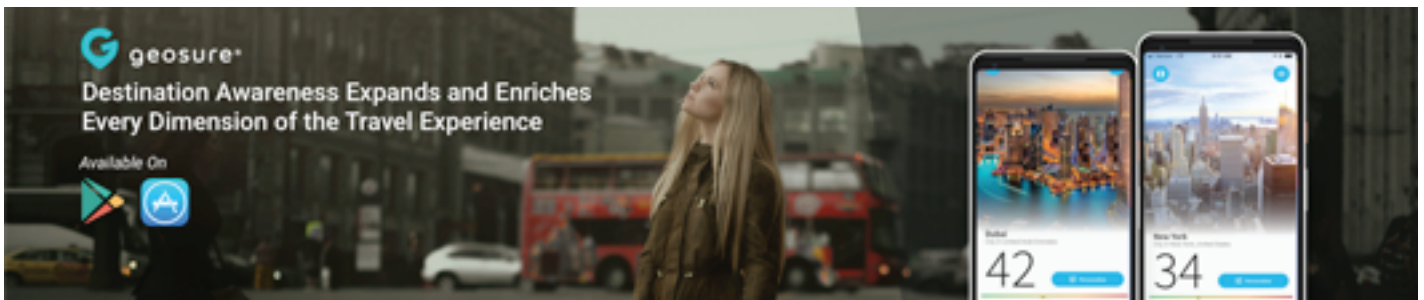
Advanced IoT and predictive intelligence technologies are being integrated into the design of smart cities, promising improvements to public safety but also raising "Big Brother" concerns about mass surveillance. This means that security in public spaces inevitably has different requirements from security in restricted areas. In public areas, authorities are limited in their actions by the requirement not to breach people's privacy; in restricted areas, it is easier for organizations to demand that people identify themselves.

Video and IoT-linked sensors to gather data, and analytic capabilities to draw insights from that data, will be the core technologies underpinning ubiquitous tourist safety. These technologies can flag up potential danger based on different indicators – for instance, the way people walk or gather as a group. Security officers or policemen will be supported in their jobs by video analytics to analyse crowd behaviour and emotions, and facial recognition technology to spot known offenders in a crowd. These technologies create a virtual security fence, which isn't dependent on physical checkpoints.

As part of its Smart Nation programme, Singapore deploys a significant number of sensors and cameras that help the government monitor everything from the cleanliness of public spaces to crowd densities to the precise movement of every locally registered vehicle. 41 In anticipation of hosting the 2014 FIFA World Cup and the 2016 Olympics, Rio de Janeiro made heavy use of its IBM-designed Operations Centre, which combines video and other data from 30 agencies including traffic cameras, subways and even weather satellites.

Case Study: GeoSure – Crowdsourcing Travel Safety Data

GeoSure is a customized personal safety app for travellers that aggregates hundreds of data sources and live crowdsourced safety reports. Data is captured from Interpol, the United Nations, World Health Organization, Centers for Disease Control and Prevention, country and city crime statistics, human rights organizations, private and proprietary data feeds, as well as from users submitting reports about on-the-ground threats. Predictive algorithms then produce GeoSure Safety Ratings (taking into account political threats, cybersecurity, health risks, environmental hazards and special threats to women) for nearly every city in the world with a population exceeding 100,000. GeoSure will soon offer a similar service at neighbourhood level.



Value-at-stake impact

Safety and security: Value at stake in numbers
(All figures cumulative for period 2016-2025)



Security is a central concern for players across the aviation, travel and tourism ecosystem, and it is expected to remain an area of significant investment. The market for airport security is forecast to grow from just over \$8 billion today to almost \$13 billion by 2023, excluding the cost of security personnel.⁴⁴ IATA reports that airlines pay close to \$9 billion annually for aviation and border security

Given that providing a basic level of security is an unavoidable cost of business for the travel industry, not all investments in security infrastructure have been considered in the value-at-stake analysis. Instead, the focus has been on measuring the potential of digital technology to improve both the effectiveness and cost-efficiency of security

The greatest benefit of improved security – avoiding a major terrorist attack – is difficult to quantify, as the number and severity of incidents of this kind is more probabilistic than deterministic. However, events such as the 11 September 2001 attack on the World Trade Center illustrate the catastrophic damage that they can cause. Besides, the thousands of lives lost in the tragedy, it had a huge economic impact. With estimated losses to air traffic revenue of \$10 billion, to the insurance industry of \$40 billion, to property owners of \$22 billion, and to the city of New York (damage to infrastructure and reductions in taxes and job losses) of \$95 billion. **To the extent that better security prevents such events, it should be considered as costs avoided or value at risk for the society**

The value at stake for this theme is relatively small as the overall benefit to the global economy of preventing major incidents has not been included in the analysis.

Value for Industry

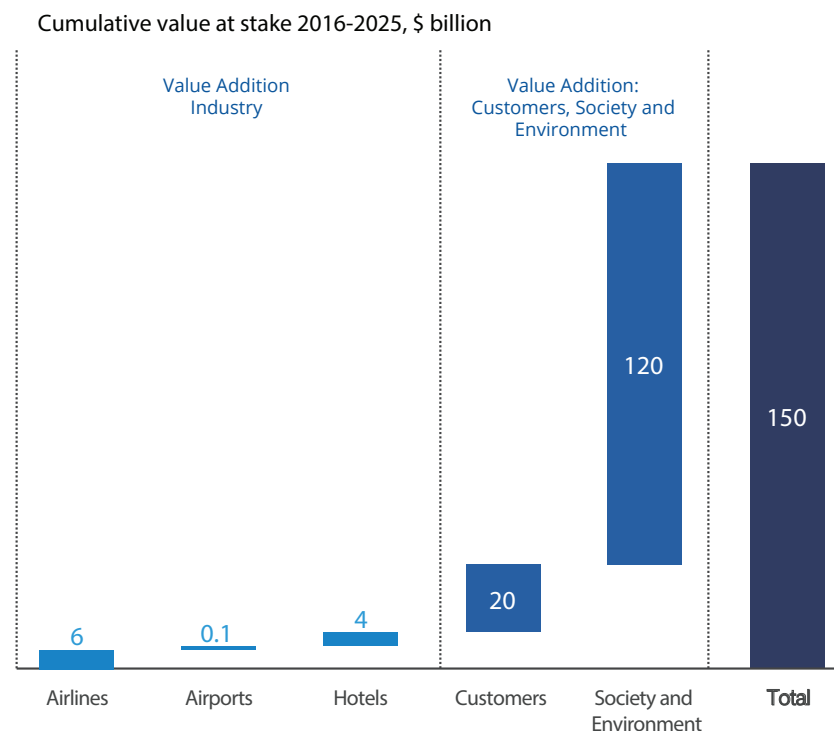
- **Cost-efficiency for industry – \$7 billion.** - In the future, airlines and airports are expected to jointly invest in more advanced screening technologies such as facial recognition systems and 3D X-ray devices. It is likely that they will also redesign security processes to drive efficiency, especially in the security queues at airports. For example, deploying centralized image processing systems and redesigning the security process flow has reduced waiting times at the Gatwick airport.⁴⁷ It is estimated that these improvements could translate into annual savings of \$1 billion for airlines in 2025, assuming that they save 30% of the security costs passed on to them by security authorities. Hotels are also expected to adopt smarter security measures with an ecosystem of connected devices and better security algorithms. This could lead to a 10% improvement in security workforce productivity, equivalent to annual cost savings of \$0.7 billion in 2025
- **Revenue growth from increased air traffic – \$3 billion.** Airlines also benefit from increased demand for flights, thanks to passengers developing a more positive view of airport security. It is anticipated this would lead to a 5% increase in air traffic in applicable markets, particularly on short-haul routes where road transport is a realistic alternative. This would generate an additional \$0.6 billion in annual profits in 2025.

Value for Society

- **Cost and time savings for customers – \$20 billion.** Customers would benefit from reduced security fees, resulting in annual savings of \$1.9 billion in 2025. Faster processing at airport security could save passengers up to 200 million hours annually by 2025. These time savings is valued at \$2.1 billion, thanks to the productivity improvements they enable.
- **Avoiding the economic costs of a major attack – \$120 billion.** To estimate the benefit to society of avoiding a major attack, the economic fallout from the 9/11 was used as the primary reference point.
- **Employment – 10,000 fewer jobs** — Based on the assumption that more efficient airport security processes will require fewer people to manage them, approximately 10,000 airport security jobs are expected to be displaced over the next decade. **However, the prediction is that the impact of adopting advanced security technologies will be felt more through the empowerment, rather than replacement, of human workers.** Security personnel will use data, new digital tools and smarter processes to manage security better while improving passenger flows through airports. Increased demand for security technology is also likely to have a positive impact on employment in the industries that supply it.

Together, these initiatives have the potential to create significant value for the industry, its customers and wider society. Figure 11 summarizes the value at stake from this digital theme.

Figure 11: Value at Stake from Safety and Security



Source: World Economic Forum/Accenture analysis

Disclaimer: The WEF use of GeoSure as a Case Study is in no way an endorsement of the Company or the Company's offerings