

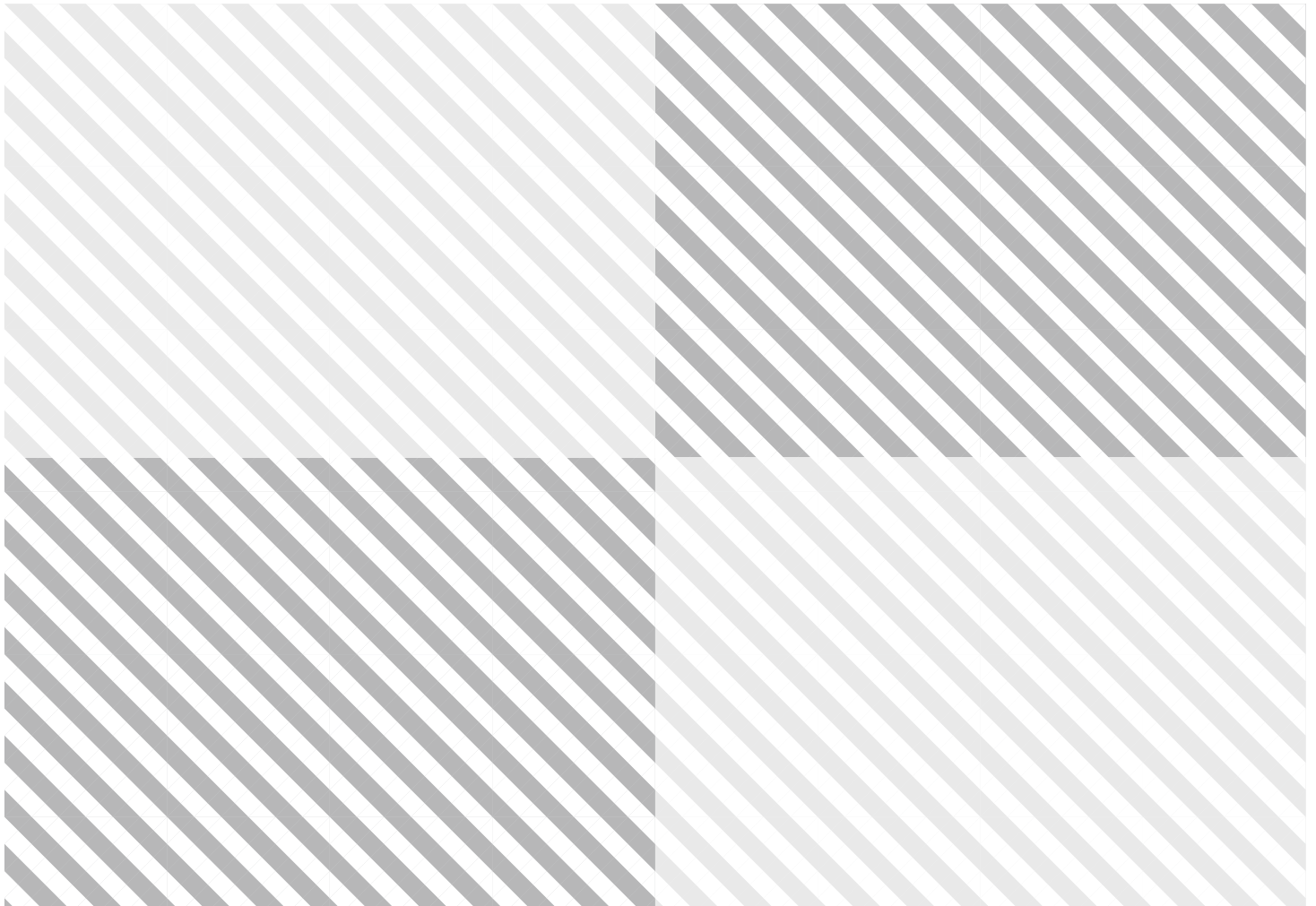
White Paper

Digital Transformation Initiative

Aviation, Travel and Tourism Industry

In collaboration with Accenture

January 2017



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World Economic Forum
91-93 route de la Capite
CH-1223 Cologny/Geneva
Switzerland
Tel.: +41 (0)22 869 1212
Fax: +41 (0)22 786 2744
Email: contact@weforum.org
www.weforum.org

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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 These include factors such as the pace of change, cultural transformation, outdated regulation, identifying the skills needed for the future, overcoming shortcomings in legacy systems, and the need to fund both digital and physical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 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:

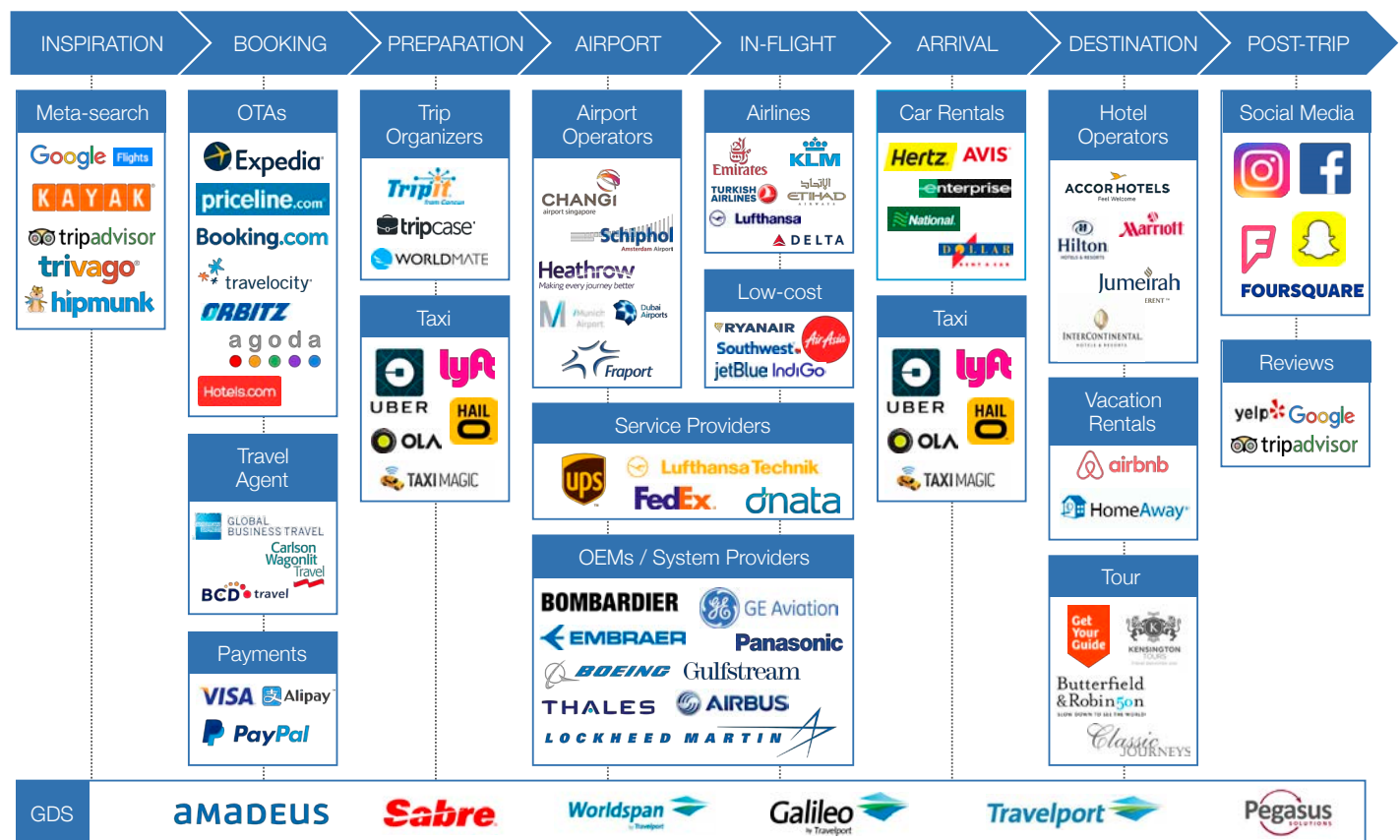
- Transform legacy systems into **agile interoperable platforms**, to enable plug-and-play interactions between partners in the ecosystem.
- Support the **transition of the workforce** by reskilling current employees through training, and empower educational institutions to design curricula that prepare 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.

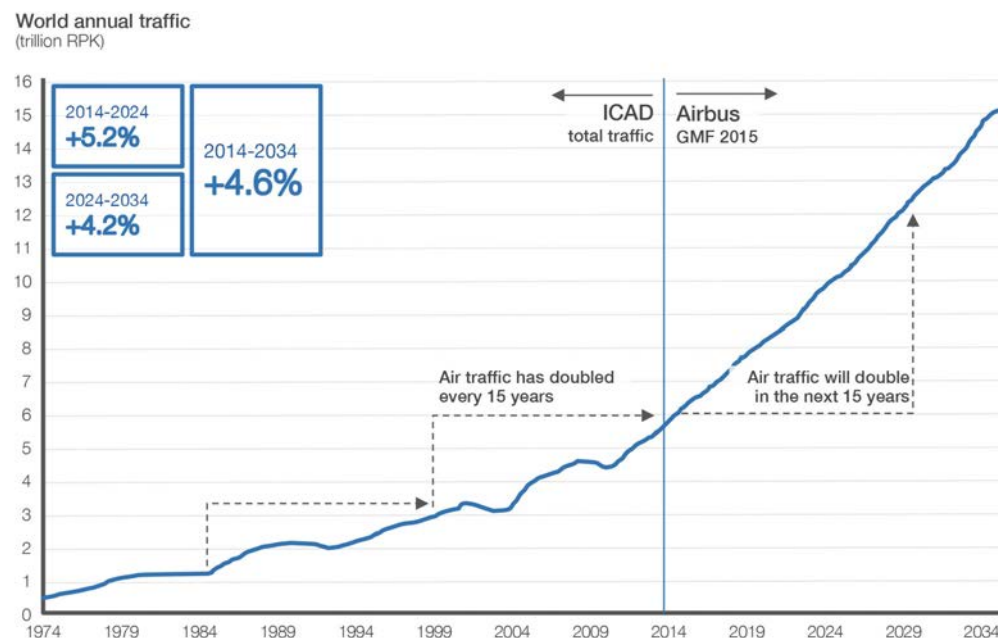
Industry trends

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 2034.²

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.³

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.⁵

Economic Cost of the World Trade Center Attack on 11 September 2001⁶

\$95 billion

Losses to New York City (jobs, taxes, infrastructure, cleaning)

\$40 billion

Losses to insurance industry

\$10 billion

Loss in air traffic revenue

83,000

Number of direct job losses

Technology trends

1. Rise of intelligent automation. Intelligent automation (e.g. robotics, 3D printing, AI and IoT) will result in high-quality services and products with a lower environmental footprint and reduced costs. Powered by AI, the next wave of solutions will gather unprecedented amounts of data from disparate systems via the multiple touchpoints the traveller has with providers.⁷

50 billion Approximate number of connected devices by 2020 – equivalent to 6.6 per person.⁸

By weaving together systems, data and people, the traveller experience will be transformed to maximize the likelihood of a rebooking due to the quality of service. From an operational perspective, intelligent automation represents a sizeable opportunity to make enterprises more efficient and effective. Connected assets, combined with AI, will allow companies to rethink their processes, simplifying and delayering organizations, and cutting out intermediaries – internal and external – that no longer provide value. Examples include dynamic network scheduling and self-rostering for employees.

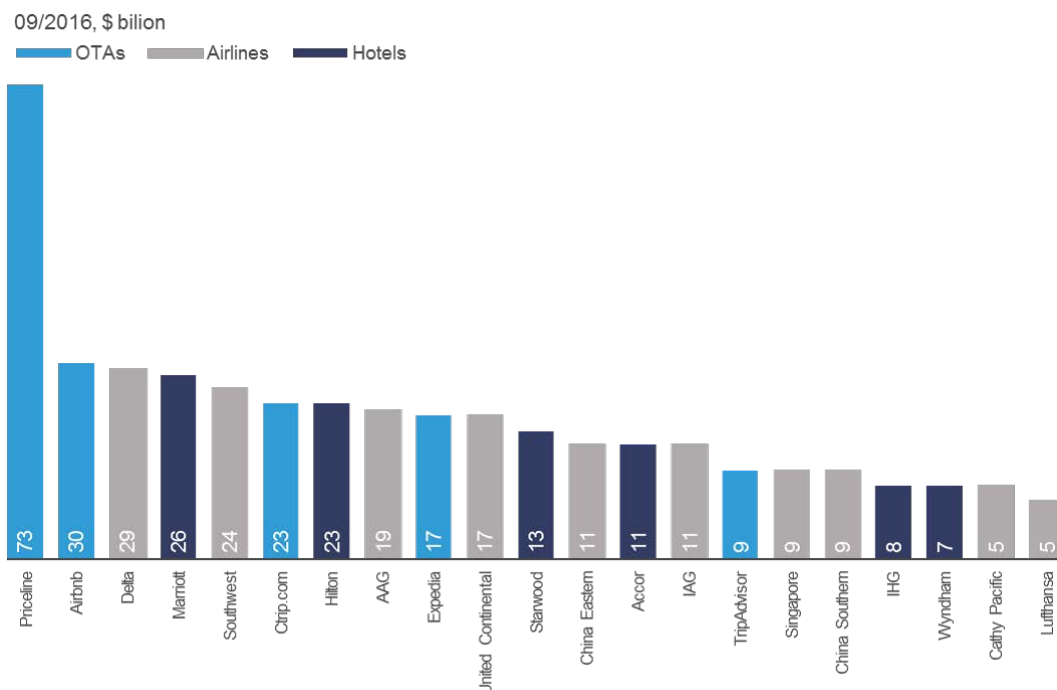
2. Dominance of digital platforms. Digital platforms are taking shape across the industry. In the digital economy, platform ecosystems are the foundation for new value creation. Figure 3 below shows the comparison of market capitalization of OTAs versus traditional industry players.

Generating innovation from the outside is the key to staying relevant. This can be achieved by extending connections with players in the same ecosystem.

50% Proportion of large enterprises creating and/or partnering with industry platforms in 2018.

Search engines such as Google already have the information to arrange seamless pickups between a flight and Uber, or tell hotels and airlines when someone books to attend a conference. It illustrates how fast the travel industry is evolving.

Figure 3. Market Capitalization Comparison of OTAs, Airlines and Hotels



Source: World Economic Forum/Accenture analysis

These technology trends are not new, but they are now deliverable at scale. Businesses should exploit these trends fast – or at least prepare for their impact – because of two major developments:

- **Digitization of everything.** Now that advanced technology is affordable and miniaturized, the barriers that prevented devices, vehicles, people and things from connecting have been torn down. A suitcase can be tracked throughout a journey; a personal assistant can tell you the time it takes to walk to the gate based on your location. Companies who fail to adopt easy technology-enabled applications will be left behind.
- **Liquid expectations.** Inspired by consumer-centric experiences in other industries, customers in the travel industry now have high expectations. Compare, for example, the way airlines cope with flight cancellations with the hassle-free way that Zappos and Zalando handle returns. Customers seek highly personalized and seamless experiences, all connected by the platform of their choice. Today, even in the low-budget segment, what the industry is currently delivering fails to live up to even the most modest customer expectations.

As each piece of a journey is digitally connected, opportunities to catalyse change and scale operations increase exponentially. Unfortunately, this enhanced ability to scale also brings extra exposure to systemic risks, especially when legacy systems are still widely used. As every digital step forward creates new risks, trust becomes a cornerstone in the industry. Without digital trust, businesses cannot use and share the data that underpins their operations. One advantage for aviation, travel and tourism stakeholders is that customers already tend to share information with airlines and hotels when they perceive it to be required for security reasons.

Influencers

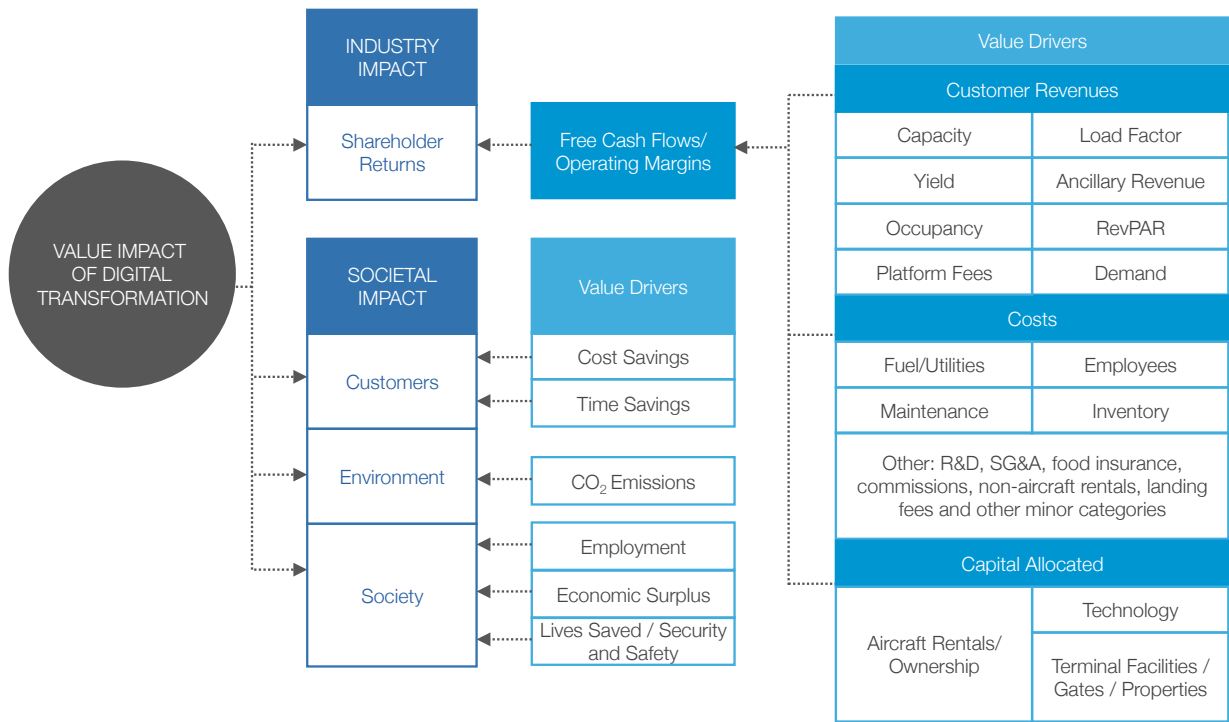
Digital transformation does not take place in a vacuum. External influences play an important role. In some cases, they can accelerate digitalization, in others, they may hinder it. Five factors expected to have a major influence on digital transformation in aviation, travel and tourism have been identified:

1. **Regulation.** Regulatory frameworks have a significant influence on the speed of transformation. They can pose major difficulties for cross-border integration, as regulations in different parts of the world can be very different. Innovation moves at a faster pace than regulation and policy-making, forcing institutions to make new regulations for nascent technologies. In some cases, regulatory regimes can discourage corporations from pursuing new technologies because they cannot be made profitable in the current regulatory environment.
2. **Legacy systems.** Companies need their legacy systems to continue operating as they develop new ones, reducing an organization's agility and capacity to transform itself quickly. Developing a multi-speed approach to IT is one way to curb the negative impact of this influencer.
3. **Infrastructure.** As asset-free business models take centre stage, the importance of controlling the quality of physical assets should not be ignored. Accelerating change from digitalization will also have an impact on future investments in both physical infrastructure and digital technologies.
4. **Jobs and skills.** Digital transformation demands a different skill set from workers in today's economy, and will create new types of jobs. Aviation, travel and tourism players will need to adapt to this transition, as digital transforms the ecosystem, with change being driven by people from within the organization. Challenges such as managing the impact of automation on employment, reskilling the industry workforce for the digital economy, and creating a safety net for workers in a flexible workforce, will need to be tackled collaboratively by industry, regulators and policy-makers.
5. **Demographics.** Demographic trends will play a role in determining demand for travel and the speed of technology adoption across regions. Thanks to a fast-growing middle class, regions in Asia, Africa and Latin America will drive the bulk of future growth in travel demand. Technology adoption, however, may be speedier in developed, rather than emerging, markets. Within markets, businesses will also face the challenge of managing experiences for both technology geeks and consumers who are less adept at using digital technologies.

Value Framework

Digitalization represents an attractive option for aviation, travel and tourism to create value, both for the industry itself and wider society. To understand the potential of digital transformation to create value, the drivers that underpin the industry's financial performance, and its societal, customer and environmental impact have been analysed (see Figure 4).

Figure 4: Drivers of Value Creation in Aviation, Travel and Tourism



How the value of digital transformation in aviation, travel and tourism was calculated

Building on this framework, the value-at-stake analysis aims to assess the impact of digital transformation initiatives on industry, customers, society and the environment. It provides estimates of global industry operating profits at stake from 2016 to 2025, and the contribution that digital transformation can make to customers, society and environment in that time frame. Value at stake for industry comprises two elements: the potential impact of digital initiatives on an industry's operating profits (value addition); and the shift in operating profits between industry players (value migration). Value at stake for society measures the value impact of digital transformation for customers, society and the environment. The net impact on employment has been calculated separately and is not included in the monetary value at stake for society.

Headline assumptions and observations for calculating the impact of digitalization in aviation, travel and tourism include:

- **Industry.** Organizations in the value-at-stake analysis include booking intermediaries, airports, airlines, aircraft manufacturers, hotels and lodging companies. These companies can benefit primarily from lower unit

cost through improved efficiencies handling higher volumes; and premiums and additional demand for offering personalized and better experiences. Significant value to migrate within the industry from traditional hospitality players to the disaggregated crowd economy, led by online aggregation platforms such as Airbnb and Uber, is expected.

- **Customer.** The benefits are clear: improved travel experiences tailored to individual preferences and time savings thanks to a seamless journey, optimized throughout the travel ecosystem. The extent to which customers benefit may depend on their willingness to use their personal data as “currency” by sharing it with service providers.
- **Society.** A lower environmental footprint through more efficient production processes and optimized utilization of assets will be a positive impact from successful digitalization. New income sources for participants in the sharing economy by utilizing their assets such as homes and vehicles are also expected to be a significant benefit. Negative impacts could arise from job losses in the travel industry, especially in simpler, process-driven roles, as a result of increased automation.

A full explanation of the value-at-stake methodology can be found in the appendix to this report.

Future Horizons: Digital Themes and Initiatives

Digitalization represents an exciting opportunity for the aviation, travel and tourism ecosystem, with the potential to unlock approximately \$1 trillion of value for the industry and wider society over the next decade. Digital transformation is impacting every element of the aviation, travel and tourism value chain. Platforms such as Airbnb and Uber have radically altered demand-side dynamics, enabling small entrepreneurs to compete with bigger players. At the same time, OTAs are using up-to-date information to change the way travellers explore travel offerings. The travel ecosystem is evolving, with blurring boundaries and changing roles across the industry landscape.

Four themes are central to the industry's digital transformation over the next decade:



Living travel experience

Travellers will experience seamless journeys tailored to their habits and preferences. Companies along the travel 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, IoT, 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.

Within each theme, specific digital initiatives have been identified that are expected to be the building blocks of digital transformation in aviation, travel and tourism over the next decade. The case studies below illustrate how these initiatives are starting to have a significant impact.

Value-at-stake headlines

The digital transformation has the potential to unlock approximately \$1 trillion of value for the industry over the next decade (2016 to 2025). (See Figure 5)

\$700 billion of societal value:

- Savings for consumers from greater choice, transparency and competition driven by OTA platforms
- Economic surplus generated for society as hosts share their underutilized assets with travellers
- Time savings for consumers, especially when planning trips and using airports
- Avoiding costs of adverse events such as the 9/11 attack on the World Trade Center in 2001

\$305 billion of value addition for industry:

- Connectivity, automation and intelligence are increasing the productivity of people and assets, and driving efficiencies
- Personalization is driving demand for products and services, boosting revenues for companies
- Sharing models are creating efficiencies for airlines and hotels by increasing utilization of available capacity
- Improved perception of security in air travel is driving higher traffic at the expense of other means of transport

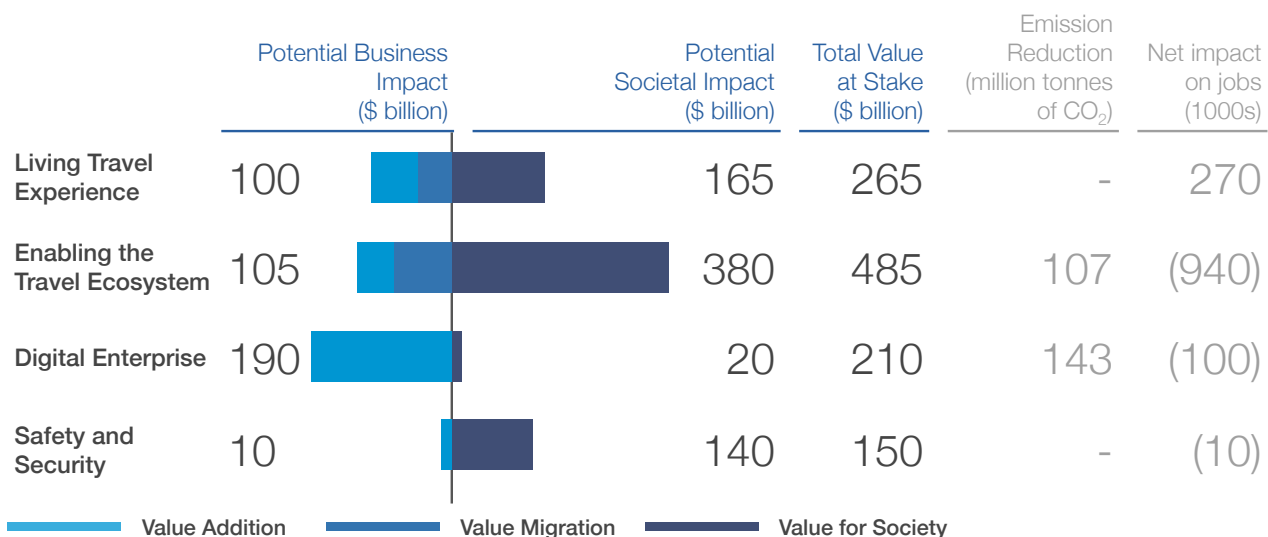
\$100 billion of industry value migration:

- Traditional travel booking intermediaries are continuing to lose out to OTAs
- Traditional undifferentiated hotels are losing out to short-term rentals/shared homes

Possible reduction of up to 780,000 traditional jobs in today's industry:

- Demand shift from traditional hospitality to sharing economy is affecting jobs in line and management functions
- Automation and productivity improvements are impacting jobs in aircraft maintenance and manufacturing, airport security and line functions at hotels
- A reduction in the number of jobs created will be partially offset by new demand for services created by OTAs, driving job growth throughout the value chain and in the sharing economy
- It will also be offset by potential job gains outside the industry's value chain in the digital ecosystem of IoT, robotics, connectivity and data analytics (which have not been quantified in our analysis)

Figure 5: Value at Stake for Digital Themes in Aviation, Travel and Tourism



Source: World Economic Forum/Accenture analysis

a. Living travel experience

Putting customers at the centre of travel services, and integrating physical and digital assets to deliver seamless customer journeys, are vital steps towards creating highly personalized, end-to-end travel experiences.

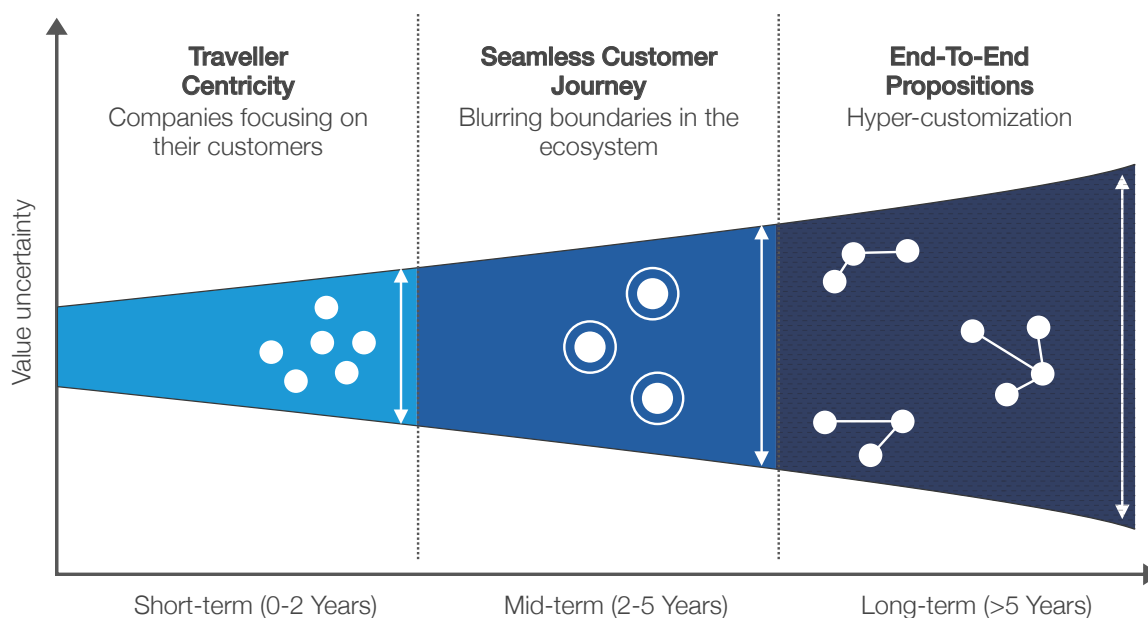


The shift from traditional travel products and services to an end-to-end travel experience will eventually lead to a seamless customer experience characterized by continuous information availability, reduced waiting and transfer times, hyper-personalized services and

optimized rerouting. Today's customers are used to high service levels in other industries, and this is influencing their expectations in aviation, travel and tourism, where fragmentation makes it difficult to optimize service levels.

Digital is the key enabler to overcoming fragmentation. Apart from creating closer connections to customers, it is the basis for interoperable data-sharing mechanisms that can connect stakeholders more efficiently all along the aviation, travel and tourism value chain. Figure 6 illustrates how organizations in the ecosystem relate to customers and each other is evolving.

Figure 6: Evolution of Living Travel Experience



- **Traveller centricity.** Today, companies throughout the value chain (e.g. travel agencies, airlines, airports, hotels) use digital to engage with their own clients (e.g. through loyalty programmes). Personalization through separate companies collecting and analysing customer habits and preferences will remain a priority for most of them now and in the short term (over the next two years).
- **Seamless customer journey.** Created through collaboration between travel companies, seamless customer journeys will be the next development. The first examples are already emerging from companies in different parts of the value chain pioneering a high-quality customer travel experience. In the medium term (between two and five years), this will become standard practice, and collaboration will bring more value to the customer, industry and society.
- **End-to-end propositions.** In the long term (five years and beyond), travellers can look forward to highly personalized, frictionless, flexible travel experience. Companies will work together and real-time AI will proactively manage the traveller experience. Collaboration will be key to delivering end-to-end propositions to travellers.

Traveller centricity



Customers will share personal data if there is a clear value proposition. If we are using that information in a way that is not transparent to that individual or very clearly just trying to monetize on that transaction – then customers will no longer share data.



Steve Singh, Chief Executive Officer, Concur Technologies, USA

In line with rising demand for traveller-centric experiences, companies will provide better, hyper-personalized products and services. By capturing personal data from customers and learning more about their behavioural patterns, companies could optimize services across the customer journey.

72% Customers willing to share location or personal data with travel providers.¹¹

Personalized services rely on customers' willingness to use data as a currency to improve their experiences. Drilling down, passengers are less keen to share personal information when they cannot clearly see the benefit, or if they think it will result in intrusive commercial services or other personal privacy violations. Successful personalization depends on data-gathering technologies (e.g. IoT or wearables) and insight-generating technologies (e.g. machine learning and analytics), which can carry out attribute and event sequence analysis, collaborative filtering and other forms of data analysis.

Personalization does not just mean learning about customer habits; it is about relating them to a specific trip and determining their relevance in that context. If a traveller always arrives late to the hotel and orders room service, why not enable that traveller to order in advance and have dinner ready on arrival? The business rationale for personalization might be a desire to build brand loyalty among existing customers and to provide a differentiated service from competitors.

Case Study: Qantas – Improving the Travel Experience through Personalization

In partnership with Umbel, a unified customer data platform, Qantas has created a data hub centred on customer preferences and behaviours to improve customer experience and loyalty. In-flight entertainment and services are already being personalized, as are real-time ticket booking and check-in processes. Qantas also has a smartphone application with a personalized interface to streamline the day-of-travel experience for customers. The app creates a personalized travel timeline, acting as a full-service travel companion that anticipates customers' travel needs. Recognizing the importance of opt-in and fully transparent data-sharing agreements, Qantas offers frequent flyer points for sharing personal preferences with third parties.¹²

Traveller centricity



In travel, digital transformation is not just about technology. To succeed, we must bring together pixels and our people to create a flawless travel experience.



George Corbin, Senior Vice-President, Digital, Marriott International, USA

Integrating operations across physical and digital assets will result in a seamless customer journey by making information available continuously, reducing waiting and transfer times, hyper-personalizing services and optimizing rerouting. The customer will move friction-free through travel touchpoints with different companies – for instance, by sharing data at a single point and having this data communicated to all relevant ecosystem entities. This integration will change physical entities too: airports will no longer be noisy and polluting eyesores on the outskirts or cities, but fully integrated parts of city centres (the closer the better). The airport will become an “aerotropolis”,¹³ with attractive shopping malls, restaurants, lounge areas and business districts nearby, making travel a part of people’s lives, rather than an interruption on the way from point A to point B.

Technologies underpinning seamless customer journeys will include data-sharing platforms that enable collaboration between companies. Blockchain could enable personal data to be exchanged safely and securely. Interoperable systems – within organizations and across ecosystem stakeholders – are a prerequisite for collaboration. Such interoperability will allow the full spectrum of stakeholders along the customer journey to react in sync to real-time changes in customer preferences or unforeseen circumstances. For example, a flight cancellation would trigger an information update for a taxi driver to take the passengers to another airport that has a substitute flight.

Case Study: Spencer – the Robot Guide for Passengers Making Flight Connections

Every day, travellers miss connecting flights for all sorts of reasons, including delays, restricted transfer times, losing their way and language barriers. KLM wants Spencer to help transfer passengers find their way from one gate to another as quickly and efficiently as possible at Amsterdam Airport Schiphol. Spencer should be able to recognize groups, take group behaviour into account and recognize emotions. It will proactively respond to unexpected situations. This makes the journey seamless, with airport and airline providing an integrated service.

End-to-end propositions

End-to-end propositions are starting to overhaul traditional methods of booking elements of a journey (e.g. flights, transfers and hotels) separately. Fully integrated and personalized travel experiences can be booked quicker and more easily. It could even be possible to create a push model for booking travel, where you are sent a proposition before you even start searching for airfares or accommodation, based on events in your calendar and your past travel preferences. All operational tasks would be handled in a smart machine-learning environment, with feedback loops continuously improving the service. The first two initiatives in this digital theme are prerequisites for this one, which would rely on similar technologies to those other initiatives: IoT, AI and analytics.

Imagine, for example, that the health indicators on your smart watch, such as stress and energy levels, can notify you when you need a relaxing holiday. With historical data showing that you recover better in the wilderness of Norway than on a Hawaiian beach, a 10-day trip is booked automatically to Sweden (since you have already been to Norway and reviews say that Sweden is more like Norway than Hawaii). During those 10 days, your Outlook agenda has only three meetings of “intermediate importance”; these are rescheduled automatically. In this sort of ecosystem, travel agencies can offer a subscription model that provides travel experiences as a service to the customer.

Case Study: Pana – Offering Virtual Travel Assistant Services

Pana, a mobile travel agent and AI-powered virtual concierge, helps curate end-to-end travel experiences. Making an inquiry is similar to sending an in-app message, text or email. A few minutes later, Pana responds with travel options and an efficient way to book. Additional features, including price alerts for upcoming travel, automatic check-in and emergency rebooking, are available. Pana also supports accommodation bookings, whether at partner hotels or even Airbnb, and provides hyper-personalized recommendations for destination restaurants and activities. The subscription concierge model is accessible for monthly fees from \$19 for one person to \$449 for companies with fewer than 200 employees.¹⁵

Value-at-stake impact

Living travel experience: Value at stake in numbers

(All figures cumulative for period 2016-2025)



Value for industry

Major areas of profit migration and value creation for companies within aviation, travel and tourism:

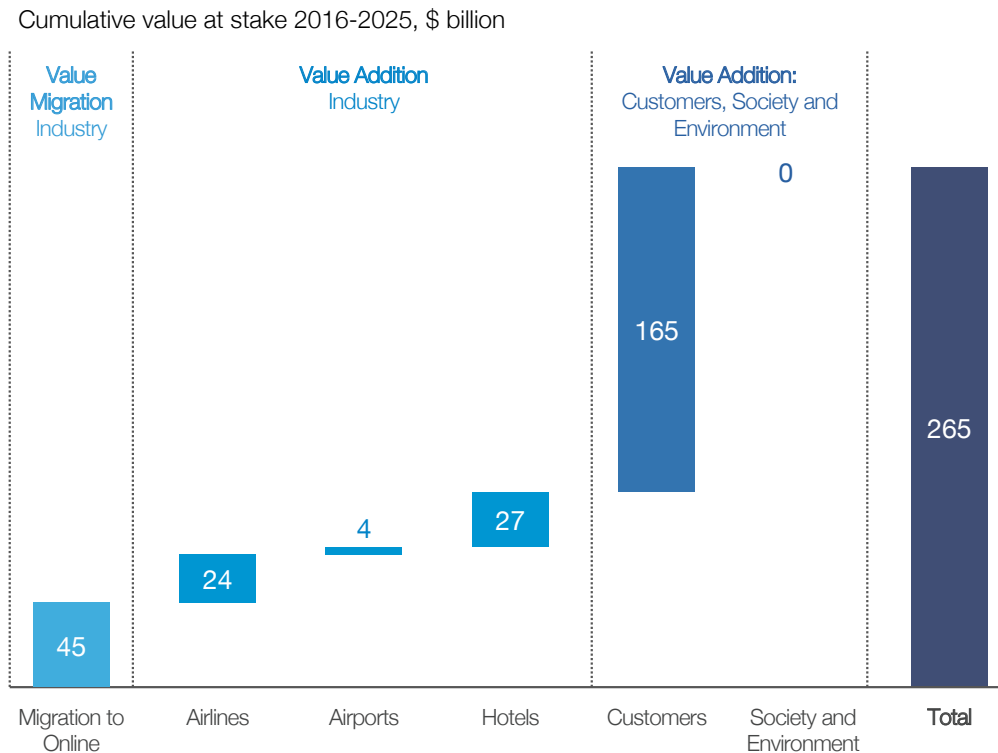
- **Profit migration from shift to online booking – \$40 billion.** The share of travel bookings made through OTAs is expected to grow from 40% in 2016 to 60% in 2025. Using 2016 as a benchmark, this is expected to cause \$220 billion in additional revenues and \$8 billion in profits to migrate from traditional to online channels in 2025.
- **Additional profit from growth of services revenues – \$15 billion.** Opportunities arise throughout the travel industry to generate revenues from more personalized services. For airlines, more relevant recommendations before, during and after flights are expected to expand ancillary revenue per passenger by 20% in 2025. Assuming that this would be applicable to 60% of customer traffic, this would result in approximately an extra \$1 billion of operating profits annually. Airports could drive additional retail sales from more personalized recommendations (e.g. vegan restaurants, favourite coffee stores or children's play areas) and airport navigation based on connecting flights, leading to an estimated \$1 billion of additional, retail-led profits in 2025. For hotels, the ability to understand guests' preferences (e.g. relating to food, their bed, exercise, entertainment and the view from their room) and personal needs (e.g. allergies and health conditions) would allow them to offer a highly personalized and enriched experience, bringing up to \$2 billion in additional profits annually by 2025. AI-driven, personalized travel concierge apps could have a significant impact but as they are still early-stage ideas, we have not included them in the scope of our analysis.
- **Operational benefits for airlines and hotels – \$40 billion.** Data-enabled personalization allows airlines and hotels to better understand each customer and operate with leaner processes without impacting service levels. As a result, airlines could reduce labour costs by 3% and administrative costs by 5%, leading to savings worth \$5 billion in 2025. For hotels, more efficient marketing could generate \$6 billion in annual cost savings by 2025.

Value for society

- **Time savings for customers in booking and during travel – \$160 billion.** OTAs offer enhanced transparency and convenience, which saves customers time in managing their travel bookings. Assuming a 5% to 15% reduction in the average booking time for business and leisure travellers, one can expect time savings of 120 million hours in 2025, valued at \$27 billion. Personalized help for passengers to find their way through airport terminals (and the shops within them) would lead to further time savings. This could save an estimated 1 billion hours of time in 2025. Assuming a 30% reduction in time spent at airports, of which 25 to 50% would then be used productively, this could generate a productivity boost of \$11 billion.
- **Cost savings for customers from lower rates – \$5 billion.** Airlines and hotels are expected to pass some of the cost savings from digitalization on to customers as lower prices. This could result in savings worth \$2.3 billion from airlines and \$2.3 billion from hotels over 10 years, assuming that 10% of cost savings are passed on.
- **Employment – 270,000 new jobs.** The baseline assumption is that job growth across hotels, airport and airlines will be 3.6% from 2016 to 2025, in line with rising demand for travel. Data-driven personalization should create more demand for products and services offered in airport retail channels, flights and hotels. This increase in demand is expected to add around 192,000 jobs for hotels, 35,000 jobs for airlines and 103,000 jobs for airport retail over the next 10 years. These gains will be partially offset by efficiencies in airline marketing functions and hotels operations, leading to the displacement of 55,000 jobs. The net effect should be that employee growth at airlines improves from 3.3% to 3.4% between 2016 and 2025. For hotels, the improvement could be slightly greater, from 4.3% to 4.6%, assuming that jobs grow in proportion to revenue growth. In airport retail, if a similar assumption is made, average jobs growth would rise from 3.3% to 4.3%. It could, however, turn out that stores see an improvement in turnover without needing more staff, especially as revenue growth would be distributed across thousands of stores.

Together, these initiatives have the potential to create significant value for the industry, its customers and wider society. Figure 7 summarizes the value at stake from this digital theme.

Figure 7: Value at Stake from Living Travel Experience



Source: World Economic Forum/Accenture analysis

Implications

Industry

Consumer data – and the ability to convert it into rich, meaningful experiences – will be a key source of differentiation. However, delivering 360-degree insights for every traveller is currently unrealistic for individual airlines or hotels. An overwhelming majority of customers are infrequent users, generating little or no personal data. Accenture analysis at a large network carrier shows that almost half of its registered frequent flyers appear to be “one-time flyers” (i.e. one transaction in a three-year period). This low interaction frequency is a significant barrier to hyper-personalization. By partnering with other entities in the value chain, the situation can be improved. OTAs and personal applications could fill this gap by providing a constant interface for travellers across trips. Their insights about consumers and the ability to influence their spending choices will become increasingly powerful. A much greater degree of collaboration is expected as industry players come together to shape the next generation of travel. This could be a single application serving end-to-end travel needs by deploying AI to analyse consumer insights from within and outside the travel ecosystem. The creation of an end-to-end mega platform is more likely to come from outside the traditional travel industry than from a player already within it. It is possible to imagine a new type of application coming into existence – a “Google Travel”, perhaps – that links to consumer data, OTAs, transport services such as Uber, rail and bus, and payment partners to form an intelligent, single-window travel assistant.

Government

It is up to stakeholders from industry, government and civil society to create an environment that improves customer offerings, while avoiding negative consequences, such as data privacy breaches. This requires a clear regulatory framework covering who may use what data, what purpose it can be used for, where it can be used and who is protecting it. (See the digital initiative Traveller Data Privacy below for further discussion of this topic.)

Civil society

The hyper-personalization of travel services is only possible when customers are willing to use their private data as currency. Will they make data available in return for improved suggestions and services, direct discounts or increased safety? The appetite to share data is growing, especially among millennials, a demographic that will be increasingly important in the next 10 years. When the benefits are clear, the willingness to share data grows.

Key questions

- How can industry collaborate to create interoperable standards for data sharing that enable seamless journeys to be delivered?
- How can industry players be better incentivized to share customer data with one another?
- How can industry gain customer trust and gather the customer data required for hyper-personalization?

An illustration of sharing data to improve services is the EU-funded VIAJEO project. It is an open platform combining data from public transport service providers, taxis and roadside monitoring to enable service providers and city traffic managers to manage urban traffic, reduce congestion and develop long-term plans for mobility. Cities involved in the scheme include Athens, São Paulo, Beijing and Shanghai.¹⁶

b. Enabling the travel ecosystem

The growing power of digital platforms is reshaping the travel ecosystem, making new business models viable and intensifying the battle for customer mindshare.



“

Do not reinvent the wheel. Partner with experts who have a competitive edge – a team effort across industry is necessary.

”

Aireen Omar, Chief Executive Officer, AirAsia, Malaysia

Digital transformation is disrupting the industry; as new players enter the field, others will retreat. It is hard to foresee the shape of the travel ecosystem in a decade's time, but significant shifts are likely to occur. These changing industry dynamics will make new business models both viable and increasingly important.

Currently in the industry, there is a disconnect between the services a company offers and the share of the industry profit pool it receives. The growing power of digital platforms within the travel ecosystem is intensifying this trend. The platform economy may be making Adam Smith's “invisible hand” a reality – bringing supply and demand into perfect harmony – but could also introduce winner-takes-all economics into the industry.

The emergence of the platform economy is making the battle for the consumer more ferocious. This battle will unfold differently across segments where customer needs differ, e.g. business and leisure travellers. Collaboration between ecosystem players will increase their chances of winning customer share. Companies may deploy different strategies to stay relevant in the transformed travel ecosystem: some will expand their coverage in the value chain, while others will limit direct customer activities and focus on delivering assets or services.

Ecosystem convergence

“

In the past, best-in-class technology was found in hotels, but now homes are becoming more and more connected. If a guest has experienced having a fully integrated digital ‘Nest’ in their home or a first-class mobile app experience elsewhere, they will certainly expect that level of digital capability at the hotel as well.

”

Michael Menis, Senior Vice-President, Digital and Voice, InterContinental Hotels Group, UK

Industry players are forging new collaborations and expanding existing ones, both inside and outside the traditional boundaries of the aviation industry. As companies at the edge or outside the travel ecosystem are drawn in, traditional industry roles will blur and become less relevant. This phenomenon – an ecosystem convergence – brings new products and services.

Collaboration is essential to unleash the full potential of the converged ecosystem. This collaboration may not be straightforward, however, with some companies potentially losing customers to others in the value chain. It also raises the possibility that partner organizations may become competitors. This could arise from the vertical and horizontal integration that is likely to take place as industry players expand their activities. An example would be an airline acquiring hotels and, in so doing, entering another part of the value chain.¹⁷

Case Study: HNA Group – Expanding its Portfolio of Travel Businesses

Vertical integration to own more of the travel experience has been attempted often in the past, but with limited success. However, digital technologies now enable acquirers to create a more connected and homogenized end-to-end experience for their customers. China's HNA Group is in the process of acquiring the American hotel brand Carlson Hotels, along with its majority stake in the Rezidor Hotel Group. HNA has stakes in an expanding portfolio of travel businesses, including sister companies across airlines, travel and lodging (e.g. NH Hotel Group, Swissport International, Azul airline, International Currency Exchange). One of the reasons Carlson gave for its interest in joining the HNA Group was "[the] increased ability to accelerate growth through investments in areas such as digital, owned assets in major gateway cities, building Radisson RED and other new brands." With its platform of global operations across the full spectrum of the aviation, travel and tourism ecosystem, HNA aspires to be one of the 50 largest companies in the world by 2030.¹⁸

The battle for customer mindshare

As the competitive landscape in the travel ecosystem becomes more complex and intertwined, attracting and retaining customers will become more difficult. Horizontal and vertical integration means that all players have a good understanding of what customers need and want, so how can companies gain a competitive advantage in this battle for the customer?

Two factors are critical to winning customer mindshare:

- Increased interaction with customers enables a company to know their customers better. This, in turn, allows a company to optimize its products and services to meet customer needs. This positive feedback loop makes it difficult for late adopters and poorly integrated players to compete.
- Better connections and greater collaboration with others inside and outside the travel ecosystem are also critical sources of competitive advantage. Greater integration allows companies to access more data and use it to optimize customer relationships. Companies will need (real-time) data-sharing and data-standardization capabilities to capitalize on this competitive advantage.

Case Study: Marriott – VR in your Hotel Room

In-room entertainment options are growing at Marriott Hotels. VRoom Service lets guests order VR experiences that can be enjoyed from the comfort of their own rooms. Users can explore the streets of Beijing, an ice-cream shop in Rwanda or the Chilean Andes. As VR is adopted more widely, it can redefine how content is published and how we experience the world around us. Imagine a mixed reality experience that integrates the physical and digital worlds: you could be perched at the top of a virtual Eiffel Tower, all the while enjoying a real-life French meal with a friend. It could also be applied during the inspiration and booking phases of the trip and, for some, it might even serve as a substitute for actual travel.

Diffusion of ownership



Today, there are an increasingly broad and diverse range of sharing- and access-based business models. Generally speaking, 'access over ownership' is most successful when there is a density of assets and people in a given location, and when those assets are infrequently used. When we can lower the transaction costs of sharing, it often becomes more attractive than ownership. This is the case not only for peer-to-peer platforms, but increasingly, for B2B transactions as well.



April Rinne, Adviser, Sharing Economy, USA

The sharing economy has already transformed business-to-consumer (B2C) business models, and looks set to also make a big impact in the business-to-business (B2B) world. In the travel ecosystem, there is great potential for sharing models based around company assets. These models will optimize the utilization of assets and lead to a diffusion of ownership. Different sharing models are possible: full asset providers would own assets purely with a view to renting them out, while other companies would use their own assets and rent them out when not in use.

Sharing models can benefit both asset owners and borrowers: the owner reduces the costs of ownership and the borrower will have a positive business case for borrowing the asset. In a B2B context, physical assets, services and workforces could be shared; in the B2C world travellers could use exchangeable tickets, valid across different airlines or hotel rooms, and available on sharing platforms.

As systems become more interoperable, it will become easier to share assets. The interoperability of systems, standardization in system architecture, data and definitions will be prerequisites for success.

Value-at-stake impact

Enabling the travel ecosystem: Value at stake in numbers

(All figures cumulative for period 2016-2025)



Value for industry

Major areas of profit migration and value creation for the aviation, travel and tourism industry:

- **Value migration from hotels to short-term rentals – \$55 billion.** OTAs are democratizing the hotels and lodging market, while sharing economy platforms are driving a market shift from hotels to short-term rentals. In 2025, 17% of the hotel industry's annual revenues are predicted to migrate to short-term rentals (currently, this is 7%), resulting in the migration of \$8 billion in annual operating profits. The most significant impact is to be expected for smaller hotels that rely more heavily on price-conscious leisure travellers. Premium segments and chain hotels focusing on business travellers (who provide 70% of revenues) look more immune to the shift.
- **New demand driven by OTAs – \$1 billion.** OTAs are expected to generate new demand because they offer easier ways for customers to search for accommodation and a greater range of options, thanks to short-term rentals. This will drive an estimated additional \$11 billion of bookings in 2025 and an increase of \$140 million in annual profits.
- **Additional value from aircraft sharing – \$42 billion.** Sharing units in aviation are not widespread yet, but we see a potential business case for airlines to operate shared aircraft and combine traffic on specific routes. The potential cost savings from fuel, airport expenses and crew productivity could be around \$10 billion in 2025, assuming that four flights could take the place of five on the 15% of routes where we believe aircraft sharing makes sense. This would be equivalent to an overall load factor increase of 2.5%.
- **Additional value from sharing workspace in hotels – \$7 billion.** Hotels could improve utilization of owned assets by using facilities as shared workspaces. Assuming 55% of hotels adopt this offering, earning a 5% uplift in food and beverage sales as a result, they would gain an estimated \$2 billion annual boost to operating profits in 2025.

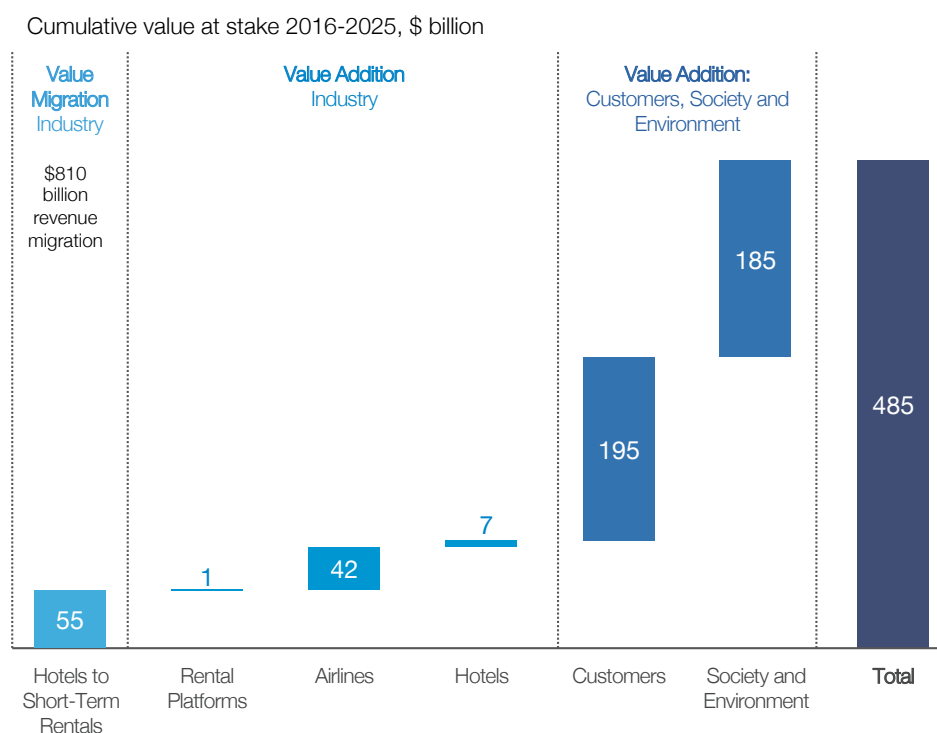
Value for society

- **Customer savings from lower accommodation rates – \$195 billion.** Customers often choose short-term rentals through OTAs because they cost less than staying in a hotel. Where OTA-led bookings substitute hotel bookings, estimated annual savings for customers could reach \$28 billion in 2025. The savings are driven by average daily rate (ADR) differences, which may vary greatly by market and scope of analysis, so there is a greater degree of uncertainty around this estimate than most others in this report.
- **Profits for homeowners sharing their living spaces – \$180 billion.** OTAs offer homeowners an easier way to rent their homes on a short-term basis, generating additional income. For homeowners renting their primary residence, annual profits of \$34 billion in 2025 is expected. The economic surplus is even higher if considering the higher rents received by commercial landlords who shift from long-term renting to short-term renting. Increased tourism also boosts the local economy in the neighbourhoods where properties are let. However, price inflation in the long-term rentals market is making housing more expensive for residents looking to buy a home. This has triggered regulatory changes in some markets such as Berlin where owners are restricted from using their property for short-term rental.
- **Emission savings – \$5 billion.** Sharing their fleet could enable airlines to reduce aggregate fuel consumption and avoid more than 100 million tonnes of CO₂ emissions over the next decade.
- **Employment – 940,000 fewer jobs.** The most significant societal impact from the migration of business from hotels to short-term rentals is expected to be seen in employment figures. The decrease in demand for hotels could reduce long-term job growth in the industry from 4.3% to 3.0%, equivalent to approximately 1 million fewer jobs. This is partially offset by increased employment in the informal sharing economy (estimated at approximately 100,000 jobs). Additional income is also expected to flow to hosts from sharing their living spaces, compensating for some lost wages. Chain hotels are expected to reduce their employee footprint in specific markets where properties lose out to short-term rentals, and thus, lead

to a more severe impact in those markets rather than a uniform slowdown in job growth across markets. Another factor to consider is consolidation among hotel chains (e.g. the Marriott and Starwood merger) as a competitive response. It could lead to reductions in the workforce, especially in corporate and overhead functions.

Together, these initiatives have the potential to create significant value for the industry, its customers and wider society. Figure 8 summarizes the value at stake from this digital theme.

Figure 8: Value at Stake from Enabling the Travel Ecosystem



Source: World Economic Forum/Accenture analysis

Implications

Industry

Developing a mindset of collaborative innovation could create new business opportunities for the traditional industry and improve operational effectiveness. Unique and authentic experiences have become a value proposition for OTA platforms such as Airbnb, meaning that traditional, undifferentiated establishments need to find a competitive response. Traditional players must adopt new business models to maintain relevance in this reshaped industry landscape. For instance, on-demand cabs and shared rides are expected to be a factor in more than 10% of passenger car sales by 2025. Traditional automobile companies, therefore, need to plan for a transition from vehicle sales to mobility services if they want to sidestep the negative consequences of disruption to their business. Another example would be the disruptive impact that e-commerce has already had on undifferentiated physical retail stores. Hospitality is witnessing similar challenges especially for undifferentiated and unconsolidated hotel businesses. For disruptors such as Airbnb, navigating

the regulatory challenges across markets remains a top priority. Since regulations are lagging industry, it creates an opportunity for players to help shape regulations. BlaBlaCar is an example of a company that has taken this approach, creating a business model focused on reducing the miles travelled by cars that is likely to appeal to regulators and be more compatible with updated regulatory frameworks.

Government

The growing influence of digitally enabled platforms brings huge potential for ecosystem convergence. But it also brings new challenges, such as the highly contested redefinition of the relationship between workers and digital platforms such as Uber. In cases such as these, the driver becomes a customer of the platform itself and loses the safety net that an employee contract with a fixed salary and sick pay would typically provide. On the other hand, the driver may value the flexibility that this arrangement offers and the potential to improve their work-life balance. Societal stakeholders, in close collaboration with labour unions, need to monitor how this relationship develops,

so as to safeguard employee benefits. Policy-makers also need to better understand and prepare for the externalities of sharing platforms such as Airbnb, especially in relation to the socioeconomic impact on the housing market.

Civil society

Consumers and suppliers have both come to accept sharing economy business models across industries. However, aspects of these businesses remain contentious, as illustrated by the lawsuits brought by some Uber drivers against the ride-sharing platform, alleging that it misclassified them as independent contractors rather than employees. It remains to be seen how comfortable the majority of people feel about trading the safety net provided by a regular job for the flexibility that working in the sharing economy can offer.

Key questions

- How can regulations keep pace with innovations in the sharing economy? How can the value of asset-sharing be unlocked while maintaining fair market practices?
- How can public-private collaboration support the sustainable transition of individuals from traditional employee roles in the industry towards increased self-employment in the gig economy?

A clear example of asset-sharing models that conflict with the current regulatory environment is Airbnb. In 2016, Airbnb took cities such as San Francisco to court over ordinances that forced the company to remove listings that violate city laws. In a recent ruling in November their request was rejected.²⁰ In Europe, Berlin has tried to prevent residential properties from being used for commercial interests such as sharing through Airbnb. People who let more than 50% of their apartment on a short-term basis without a permit from the city risk a fine of €100,000.

c. Digital enterprise

Technologies such as 3D printing and cloud computing offer companies the opportunity to radically reinvent their operations. These changes will boost efficiency but also have a significant impact on the industry's workforce.



Until now many companies have concentrated their digital investments on the customer-facing side of their business, investing, for example, in websites and mobile interfaces. However, it is important to recognize the vast potential for generating efficiencies and cost reductions that digital technology offers to the operational side of the industry.

Efficiency in operations has always been on the industry's agenda, notably with Lean Six Sigma-style approaches. Digital enables companies to take the next step, by focusing on improvements in their core processes. Important examples include:

- With 3D printing, production processes can be cheaper and quicker, while yielding higher-quality output with a smaller environmental impact. Products that are 3D printed are also lighter, have a longer lifetime and require less maintenance (especially when coupled with predictive maintenance technologies enabled by IoT and analytics), thus reducing operating costs.
- In the medium term, cloud-based solutions can replace legacy systems, allowing assets to be connected and operations to be radically reinvented. This shift will create agile organizations in which innovation can flourish.
- Deploying new technologies and rethinking operations requires a next-generation workforce, with new skill sets and the ability to work effectively with intelligent machines. Technologies such as VR will empower less skilled workers to perform more complex tasks.

Intelligent automation will also have an impact on both employment levels and the characteristics of certain jobs. Some jobs may be partially or completely displaced by automation, but the rapid growth of the travel market, enabled by digital technology, has the potential to create new “digital” jobs (e.g. digital designers and data scientists). At the same time, a more flexible workforce will emerge, capable of providing services for multiple employers in parallel. In this new ecosystem, operations will need to be interconnected, both in terms of technology and the management of a “liquid”, flexible workforce.

Reinventing operations may take place largely unseen by travellers, but it will impact customers and many aspects of their journeys. For example, will they still need to check in at a hotel lobby? Will there be security checkpoints at airports? Or will digital blur these physical boundaries?

Smart manufacturing

Using smart manufacturing technologies such as 3D printing in the production process will result in products that are 30% to 55% lighter and cheaper.²² In contrast to traditional subtractive manufacturing, 3D printing (also called additive layer manufacturing or ALM) creates “a physical object by printing layer upon layer from a digital 3D drawing or model”.²³ Until the mid-2000s, only soft plastic could be 3D printed and only for limited applications. Since then the range of materials that can be used with 3D printers has expanded significantly, opening up many more applications for 3D-printed products across sectors as diverse as aerospace, automotive, electronics, health and education.²⁴ Applying this new technique in manufacturing reduces complexity, enabling highly optimized, on-demand and customizable solutions at little additional cost per unit.

Joint innovation platforms and flexible production sites will be important factors in realizing efficiency gains throughout the supply chain. Shipping and inventory storage of aircraft parts can be time-sensitive and expensive, but on-demand 3D printing of parts has the potential to transform the aviation supply chain and enable the real-time customization of parts.²⁵

In the short term, 3D printing will mainly impact the airline industry's original equipment manufacturers (OEMs), and maintenance and service providers. As this is a high-capital, R&D-intensive industry, the ability to maintain the security of designs and intellectual property is a prerequisite for the adoption of smart manufacturing in the industry. In the long term, other areas of the aviation, tourism and travel ecosystem may benefit from the use of 3D printing, e.g. the production of low-cost items such as shampoo bottles for the hotel industry.

Case Study: Airbus – Exploring Innovative Applications of 3D Printing

Airbus Group has started using 3D printing for tooling, prototyping, making parts for test flights and aircraft in commercial service.²⁶ There are also plans to use 3D printing to manufacture missing and nonstandard parts on demand and in low quantities, to minimize disruption in the manufacturing process. More than 1,000 parts of the A350 are now made by 3D printing – more than on any other commercial aircraft. In addition to exploring innovative applications for raw materials, Airbus is also pushing forward on the regulation front, e.g. by working with the European Aviation Safety Agency (EASA) to qualify 3D-printed titanium components.

Case Study: 3MF Consortium – Convening Ecosystem Partners for 3D Printing Standardization

Joint Development Project, 3MF Consortium, is an industry consortium working to define a 3D-printing file format that allows design applications to send full-fidelity 3D models to a mix of other applications, platforms, services and printers. Such cross-industry standardization could lead to the type of interoperability required for joint innovation platforms and on-demand printing of parts – straight on the airport tarmac.

Intelligent assets

“

There is a digital illness in the back office of almost every airline carrier. The complexity that is inherited from the sixties is the main inhibitor here. Technology changes every day but humans are not changing fast enough – the problem is not in the technology.

”

Pascal Buchner, Chief Information Officer, International Air Transport Association (IATA), Switzerland

Using operational data effectively can boost the efficiency of company assets. By deploying connected assets, organizations can increase asset utilization and reduce marginal costs across ecosystem players. The potential applications and capabilities of intelligent assets are multiplying as the availability of operational data increases.

5-10TB Daily volume of data produced by GE's new-generation GEnx engines (used on aircraft such as the Boeing 787).²⁷

+40% Improvement in manufacturing efficiency that GE expects to gain through the application of technologies such as IoT, AI and data analytics.²⁸

Connected assets are expected to be deployed across the entire value chain. Predictive maintenance is just one possible application. An example would be a plane communicating automatically to the remote control centre that it needs maintenance on one of its engines at its next stop at a specified airport. Predictive maintenance reduces downtime for assets such as planes, shrinks the costs of replacing parts and increases safety.

Intelligent assets could also revolutionize air traffic control, making holding stacks of planes waiting to land a thing of the past. By analysing historical flight data and landing slot times, air traffic control could then directly communicate with planes entering national airspace to advise them to fly at the optimum speed to arrive at the airport at the right time.²⁹

Intelligent assets could also have numerous applications elsewhere in the industry. For instance, trays from hotel restaurants could be tracked and employees notified whenever trays are left in the elevator or in a guest's room. Cargo trucks could be given smart routes based on real-time traffic information (smart assets), increasing fuel efficiency and on-time delivery rates for goods.

Infrastructure could also be equipped with smart sensors. A recent invention is smart concrete – effectively concrete equipped with sensors that provide information to enable the infrastructure owner to optimize maintenance, and thus significantly increase the infrastructure's longevity. Used in this way, intelligent assets can contribute to improving sustainability and minimizing environmental impact by increasing the lifespan and efficiency of assets.

Case Study: Rolls-Royce – Keeping Track of Engine Health in Real Time

Rolls-Royce's Engine Health Management (EHM) system, enabled by on-board sensors and live satellite feeds generating hundreds of terabytes of data, tracks the health of its engines worldwide.³⁰ EHM is a form of predictive monitoring that utilizes real-time or post-flight engine performance metrics to flag potential threats and recommend improvements in engine efficiency. By using EHM, the Rolls-Royce Trent 7000 engine enables the Airbus A330 to be 14% more fuel efficient. Rolls-Royce is now monetizing big data from its engines via its new service model, TotalCare, under which customers are charged per hour for the use of its engines.³¹

Case Study: CytexOne – IoT-powered Automation for Hotels

CytexOne offers a comprehensive suite of systems for hotels covering almost every aspect of a guest's stay. Its technology covers everything from ventilation, lighting, occupancy detection and entertainment to minibars. All of these are overseen by the company's Atlas remote monitoring system, which provides diagnostics and predictive maintenance on a subscription model. CytexOne claims that its hospitality automation, powered by IoT and real-time data, reduces labour costs, utility consumption, property maintenance charges and operational expenses. Its technology is showcased in the recently opened William Vale boutique hotel in Brooklyn.³²

Next-generation workforce

Automation is likely to have a significant impact on the industry's workforce. So far, media attention on this subject has focused on fears that robots and AI could displace human workers. However, the creation of a next-generation workforce, requiring humans and machines to work side by side, will be an important trend.

It is expected that some simple, process-driven jobs will be partly or entirely taken over by automated systems, particularly repetitive tasks that do not involve human interaction. Hotel and airline check-in are examples of

processes that could potentially be delivered reliably and at lower cost by machines. Advances in robotics, AI and IoT could lead to more complex tasks being automated, e.g. a robot assistant providing room service in a hotel. Supported by a concierge powered by virtual intelligence, the robot could even give the customer restaurant tips based on their social media footprint.

The ability of humans and machines to collaborate effectively will, however, be the defining feature of the next-generation workforce. Human capital will be key, with digital technologies augmenting a worker's ability to make smart decisions based on real-time information. Technologies such as VR will have an important role in supporting the workforce: maintenance engineers specializing in aircraft engines, for instance, could be trained to maintain new models through VR-powered training.

Industry players are already finding innovative ways to use digital technologies to boost the performance of their human workforces. For example:

- Gulfstream is combining 3D-printed prototypes with VR in the design and prototyping of its aircraft, enabling engineers to be fully immersed in their designs in a way that was previously unimaginable.
- EasyJet, the European low-cost carrier, uses drone technology in aircraft inspections, reducing aircraft downtime and saving its engineers time.
- Japan Airlines and others are experimenting with using augmented reality (AR) wearables such as Google Glass in aircraft maintenance.
- Hilton Worldwide is implementing service optimization, powered by Amadeus intelligent automation. It is also testing an AI-powered concierge robot for its chain of hotels in the United States through a partnership with IBM Watson.

Case Study: Henn-Na Hotel – Operating the First Robot-staffed Hotel

Japan's five-star Henn-na Hotel is the first hotel to be equipped with intelligent robots as its staff. It aims to be "the most efficient hotel in the world" by reducing manpower and having robots of various shapes and sizes make up 90% of its personnel. Japanese-speaking guests are greeted by humanoid robots at the reception, while English-speaking guests are met by a robotic dinosaur. Functional droids are distributed across the hotel to carry luggage, man luggage lockers and provide housekeeping services. The hotel is also equipped with state-of-the-art technologies such as facial recognition for guest room access, tablets to make in-room service requests and radiation panels that can detect body heat and automatically adjust ambient temperature.³³

Value-at-stake impact

Digital enterprise: Value at stake in numbers

(All figures cumulative for period 2016-2025)



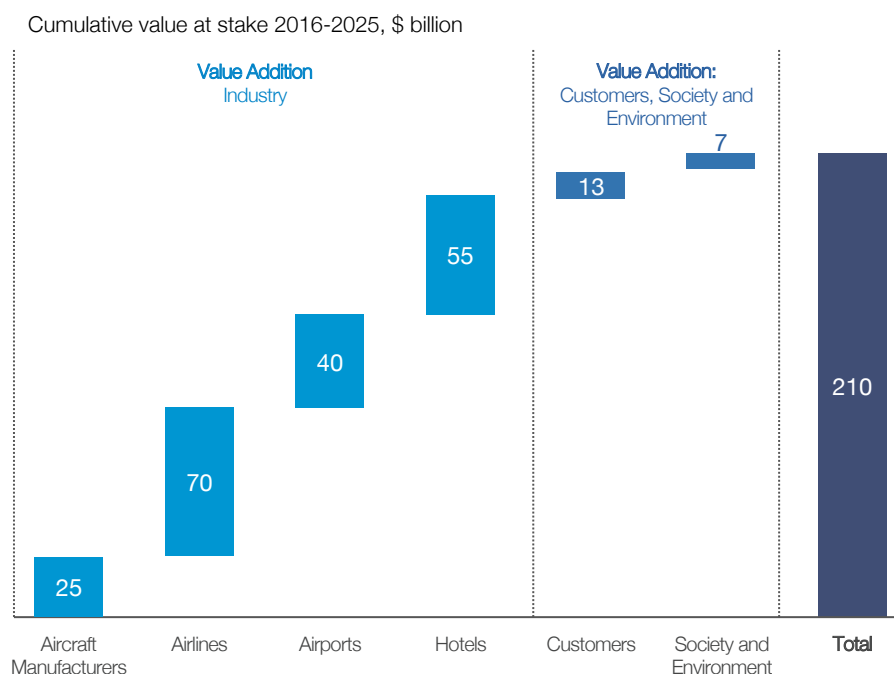
Value for society

- **Customer savings from lower prices – \$13 billion.** Assuming that 10% of the cost savings from the initiatives in this theme are passed on to consumers, they would benefit from \$2.5 billion in savings each year by 2025.
- **Environmental benefit from reduced emissions – \$7 billion.** Reduced energy usage from innovations covered in this theme would translate to an annual reduction in CO2 emissions of 27 million tonnes each year by 2025.
- **Employment – 100,000 fewer jobs.** Productivity improvements and efficiencies will reduce the dependence on human workers in several segments of the industry. However, this should not have a major impact on overall job growth across the industry; approximately 61,000 jobs at hotels, about 25,000 at airlines, an estimated 12,000 at airports and roughly

4,000 at aircraft manufacturers will be displaced by increased digitalization. This would be equivalent to the average annual growth rate in employment in these areas decreasing from 3.7% to 3.6%. With more than 650,000 jobs expected to be created in these industries between 2016 and 2025, this is a fairly small impact. Job losses would predominantly affect line employees at hotels, maintenance workers at airlines, ground personnel at airports and R&D staff at aircraft manufacturers. The slowdown in job growth in these areas will also be offset by increased employment in the industries supplying the technologies (e.g. AR, VR, analytics and 3D printing) that underpin the initiatives in this theme.

Together, these initiatives have the potential to create significant value for the industry, its customers and wider society. Figure 9 summarizes the value at stake from this digital theme.

Figure 9: Value at Stake from Digital Enterprise



Source: World Economic Forum/Accenture research

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.³⁶

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.³⁷

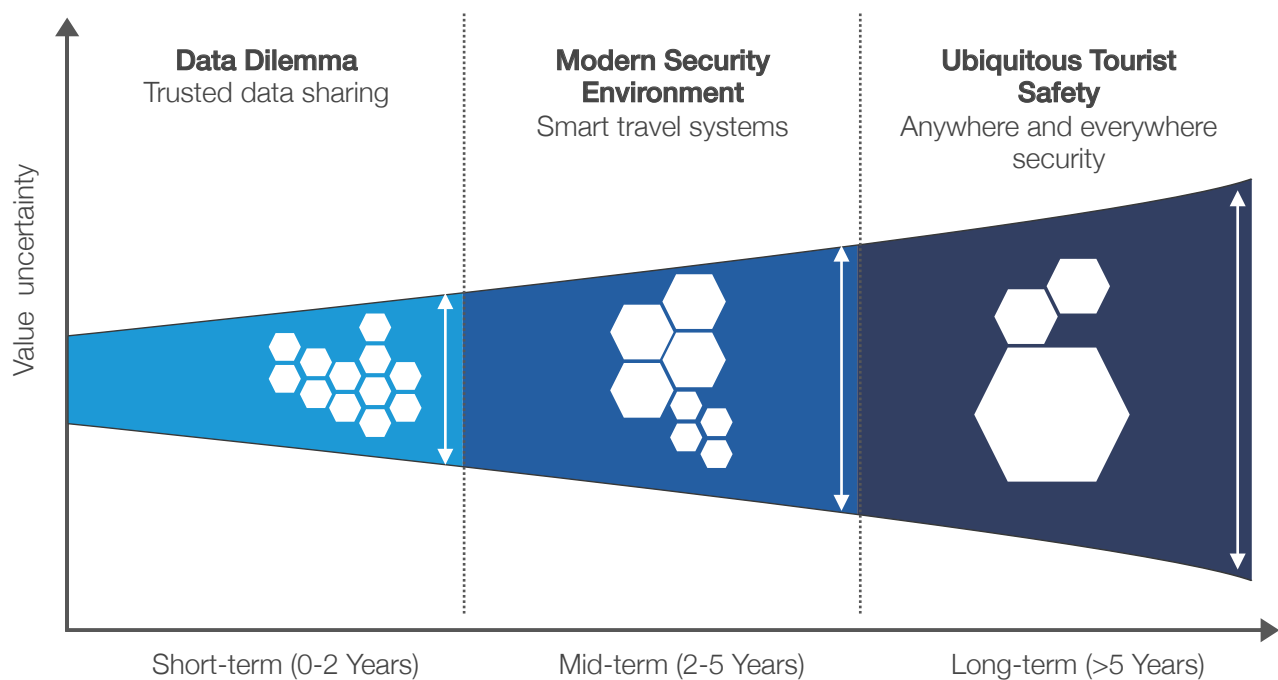
d. Safety and security

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.³⁸

Modern security environment

“

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

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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.³⁹

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.⁴²

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.⁴³

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.⁴⁵

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.⁴⁶ 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

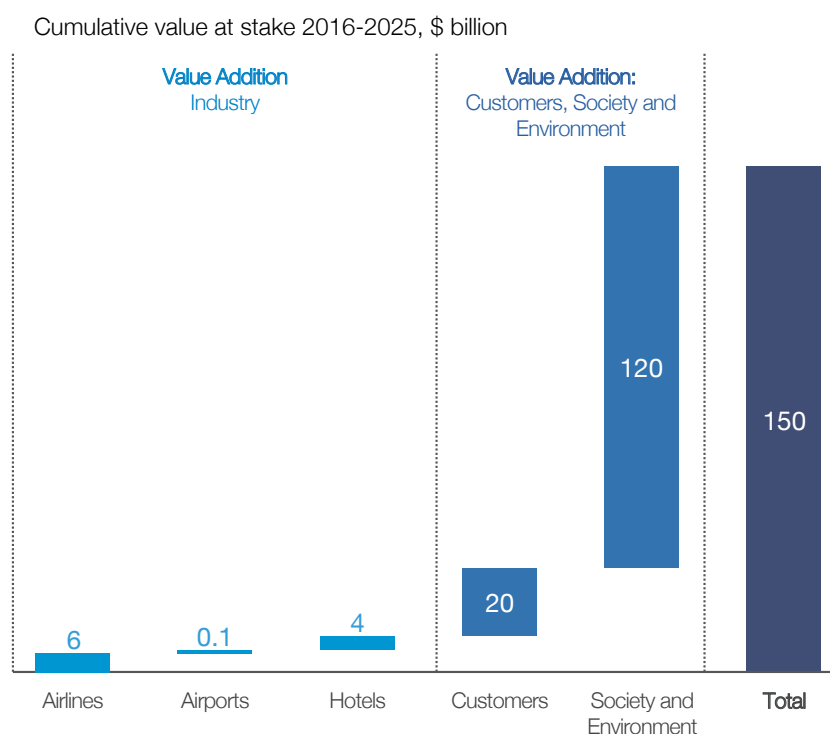
- **Cost-efficiency for industry – \$7 billion.** In the future, airlines and airports are expected to jointly invest in more advanced screening technologies such as facial recognition systems and 3D X-ray devices. It is likely that they will also redesign security processes to drive efficiency, especially 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

Implications

Industry

Data protection does not present an insurmountable technological challenge, but problems arise when it is not implemented in a consistent manner. A standardized travel identity that is interoperable between governments, airlines and airports around the globe will simplify data architecture, increase information quality and make systems less vulnerable to failure. To realize this, industry and governmental partners must align, and the industry should look to drive this collaborative effort.

Government

Customer attitudes to making their data available for safety and security schemes are important. Customers must find the appropriate balance between the risks of giving up some of their privacy and the benefits of increased safety and security. Governments have a role to play here, creating awareness and educating citizens about the risks and benefits.

Another important factor for success is the customer's attitude to data availability. Finding a balance between the threats from limiting consumer privacy and the benefits of increasing their (perceived) level of safety is important. There is a role for governmental institutions to create awareness and educate their citizens in this field. There is a clear need for a regulatory framework to support data use. To construct this, governments and enterprises should align on data governance. A possible solution could be an opt-in model, where the end user decides who can use what data and at what moment. Consumers have been found willing to share data in exchange for convenience and seamless services across industries.⁴⁸

Security and safety is a global cause, especially in the fight against terrorism, and collaboration between authorities can help protect society. The success of the technologies mentioned in the section on ubiquitous tourist safety depends on the maturity of a global information exchange between authorities and security services. It is the responsibility of governments to bolster local authorities with appropriate data infrastructure. Moreover, developed countries can play a role in boosting the capabilities of emerging countries, which should eventually benefit everyone.

Civil society

The use of biometrics, laser body and eye scanners, and facial recognition technologies to increase checkpoint safety raises ethical and health concerns. Could these technologies negatively affect one's health? In security zones nowadays, some people refuse a full body scan on religious grounds. Consumer attitudes towards visibly invasive security measures vary greatly. For example, providing the appropriate information in advance of more selective security screening could alleviate some of these concerns.

Key questions

- How can industry stakeholders securely capture and share the personal traveller data that's needed to create a modern security environment?
- How might public-private collaboration unlock investment in the modernization of security processing?

An example of the push towards sharing data is the EU directive around Passenger Name Records, which makes it mandatory for air carriers to share data relating to passenger names with authorities in member states for flights departing from or entering the EU. This development has raised concerns about data privacy. Campaign groups such as The European Digital Rights (EDRI) have argued that a five-year data retention period is too long, that the directive may not prevent discriminatory profiling of individuals, and that it will be an ineffective tool against terrorism.⁴⁹

Key Questions and Recommendations

How the aviation, travel and tourism ecosystem evolves, and whether it will capture the full value of digitalization – both for the travel sector and wider society – remain to be seen. Organizations working in isolation to exploit digital opportunities tend to implement only incremental steps, not the transformational changes that are needed. In contrast, collaboration between industry leaders and policy-makers, between the public and private sectors, can maximize the value that digital transformation generates, as the sector transitions to a new travel ecosystem. One thing is for certain: today's digital landscape will not exist in 10 years.

Key questions

Despite the uncertainty surrounding the future evolution of aviation, travel and tourism, there are a number of fundamental questions relevant to many ecosystem participants, as they ponder the impact that digitalization will have on their organization, the travel industry and society at large.

- Customers opting in to share (personal) data will enable companies to deliver a hyper-personalized travel experience. How can the travel ecosystem incentivize customers to share personal data in exchange for tangible benefits? To what extent can companies gain customers' trust that their data is indeed being used to improve their experience?
- In an ecosystem where boundaries are blurring, roles are changing rapidly, and stakeholders are reluctant to collaborate for fear of losing customer mindshare, is there a model for forging international collaboration and facilitating the sharing of information and assets, so as to unleash the full potential of digital transformation?
- The division between online and offline spaces is blurring; physical assets are becoming digital and the world is becoming smart and connected. What implications does this have for the operating model of organizations working in this environment? What will be the impact on consumer behaviour? How will customers adapt to cyber-physical experiences?
- Greater sharing of personal data enables authorities and industry stakeholders to improve security. To what degree can personal data be securely and ethically captured, and made interoperable across stakeholders responsible for the safety and security of the travelling public?

Recommendations

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 have been identified for ecosystem participants looking to make digital transformation a success:

- Legacy systems need to transform or connect into **agile interoperable platforms**, to enable plug-and-play interactions among partners in the ecosystem. This will help with asset-sharing and generate new, seamlessly integrated products and services that make travel a part of people's lives. This represents a significant investment for incumbents, but a necessary one to compete in the digital era.
- Support the **transition of the workforce** by reskilling current employees through training, e.g. massive open online courses (MOOCs), boot camps or rotation programmes. Empower educational institutions to design curricula that prepare the next generation to work collaboratively with intelligent technologies. Offer more freedom and flexibility to the workforce, enabling people to schedule their own work. Find the balance that protects the workforce and gives room for development, while keeping the industry competitive.
- With data critical to the success of the industry's digitalization, a multistakeholder approach spanning the private and public sectors and civil society is needed to deliver **regulatory frameworks that define the appropriate uses of traveller data**. These frameworks will stipulate who owns the data, who can use it and how it will be protected.

Conclusion

There are some prerequisites to successful digital transformation. Foremost among them is **strong leadership** and sponsorship from the top of the organization. Even with that in place, the biggest barrier to digital adoption can be corporate **culture**, which often resists changes to organizational structure or functions. **Clear communication** from the company's leadership on the positive impact of digitalization can combat this inertia and encourage acceptance of digital transformation. For example, the overall benefits of introducing intelligent automation for the workforce are often overlooked, with the focus resting on the negative impact it may have on a few specific work roles instead.

Many aviation, travel and tourism companies concentrate on their relationship with customers and direct their digital investments to websites and mobile interfaces. It is crucial, however, **not to neglect operations** and recognize the vast potential for efficiency and cost savings that technology can bring.

In parts of the industry, a **highly regulated environment** is stifling innovation in products and services. The pace at which new regulations are drawn up and implemented is too slow. To improve this situation, companies should keep policy-makers and regulators aligned on recent developments, narrowing the gap between innovation and regulation. All stakeholders have an added responsibility to understand the implications of a potentially widening **digital divide** in society and to take proactive actions to maximize the socioeconomic benefits of digital transformation in an inclusive manner.

Digital transformation offers many opportunities for this highly competitive industry. How the ecosystem will develop over the next decade is uncertain, but it is clear that maximizing the value of digitalization – for both the industry and wider society – rests on the aviation, travel and tourism ecosystem’s ability to work cooperatively.

Appendix: Value-at-Stake Methodology

Value-at-stake methodology overview

Value at stake is a framework designed for assessing the impact of digital transformation initiatives on the industry, customers, society and the environment. It provides a differentiated and evidence-based understanding of the extent of impact that digital transformation will have on the industry, and where potential value creation opportunities exist. It provides likely value estimates of global industry operating profits that are at stake, from 2016 to 2025, and the contribution that digital transformation can make to customers, society and the environment in that time frame.

Industry value

Value at stake for the industry comprises two elements. First, the potential impact on the industry's operating profits that will be generated because of the digital initiatives (value addition). Second, operating profits that will shift between different industry players (value migration).

Value to society

Value at stake for society includes three elements: customers, society and the environment. Each element is measured as follows:

- *Value impact for customers:* The potential gain to customers (both B2B and B2C) in the form of cost and time savings, discounts and ability to earn additional profits (for B2B only).
- *Value impact for society:* The impact (both financial and non-financial) of digital initiatives on productivity gains and jobs.
- *Value impact on the environment:* The estimated impact of the digital initiatives on increasing or reducing CO2 emissions.

Approach

The value at stake has been calculated using a top-down approach involving the following key steps:

- Identification of the total addressable market and the adoption/penetration rates over the next 10 years for each digital initiative based on secondary research, industry reports, existing use cases and interviews with subject and industry experts.
- Creation of a value tree to represent the different industry and society value categories mentioned above.
- Testing, revision and validation of assumptions and results with Accenture experts, DTI working group members and select Industry Partners of the World Economic Forum.

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Digital Transformation Initiative Project Contributors

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Pascal Buchner, Chief Information Officer, International Air Transport Association (IATA), Switzerland

Steve Cass, Vice-President, Communications, Gulfstream Aerospace Corporation, USA

Aron Cramer, President and Chief Executive Officer, Business for Social Responsibility (BSR), USA

George Corbin, Senior Vice-President, Digital, Marriott International, USA

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Hassan El-Houry, Chief Executive Officer, National Aviation Services, Kuwait

Sadiq Gillani, Senior Vice-President, Network and Fleet, Eurowings, Germany

Barry Goldstein, Chief of Digital and Distribution, Wyndham Hotel Group, USA

Simon Gros, Vice-President, Government Affairs, Travelport, UK

Celine Hourcade, Head, Cargo Transformation Program, International Air Transport Association (IATA), Switzerland

Rory Hunter, Chairman and Chief Executive Officer, Song Saa Group, Cambodia

Richard Jewsbury, Senior Vice-President, Emirates Group, United Arab Emirates

Robert Johnston, Assistant General Secretary, International Transport Workers' Federation, United Kingdom

Seshadri Krishnan, Founder and Chief Executive Officer, Trip38, India

Eric Leopold, Director, Transformation, Financial and Distribution Services, International Air Transport Association (IATA), Switzerland

Amy Ludwig, Director, Product Management Mobile Services, Carlson Wagonlit, USA

Susan McDermott, US Deputy Assistant Secretary for Aviation and International Affairs

Cheryl McIntire, Director of Digital Transformation, Lockheed Martin Corporation, USA

Ramon Martin, Former Global Head, Merchant Sales and Solutions, Visa, USA

Pierrick le Masne, Senior Vice-President, Strategic Planning, Digital, Marketing, Distribution & IT, AccorHotels, France

Michael Menis, Senior Vice-President, Digital and Voice, InterContinental Hotels Group, UK

Houston Mills, Director, Airline Safety, UPS, USA

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

Aireen Omar, Aireen Omar, Chief Executive Officer, AirAsia, Malaysia

Liesbeth Oudkerk, Vice-President, Digital Transformation, KLM, Netherlands

Andreas Raptopoulos, Co-Founder and Chief Executive Officer, Matternet, USA

April Rinne, Adviser, Sharing Economy, USA

Diego Saez-Gil, Co-Founder and Chief Executive Officer, Bluesmart, USA

Dirk Schusdziara, Vice-President, Cargo, Fraport, Germany

Bonny Simi, President, JetBlue Technology Ventures, USA

Steve Singh, Chief Executive Officer, Concur Technologies, USA

Christine Warner, Travel Head of Industry, Facebook, USA

Jeff Wilcox, Corporate Vice-President, Engineering, Lockheed Martin Corporation, USA

Daniel Yaffe, Chief Operating Officer, AnyRoad, USA

Zhang Lin, Chairman, HNA Group, People's Republic of China

Contributors

World Economic Forum

Mark Spelman, Co-Head, System Initiative on Shaping the Future of Digital Economy and Society

Bruce Weinelt, Head of Digital Transformation

Juergen Keitel, Community Lead, Head of Aerospace Industry

Tiffany Misrahi, Community Lead, Head of Aviation, Travel & Tourism Industries

Reema Siyam, Project Lead, Digital Transformation Initiative

Accenture

Liselotte de Maar, Accenture Strategy, Global Lead Travel & Tourism

Brian Goldman, Accenture Strategy, Travel & Tourism

Harshdeep Jolly, Accenture Strategy, Project Lead and World Economic Forum Seconded

Anand Shah, Accenture Strategy, Digital Transformation Initiative Engagement Partner

Rohit Bhat, Accenture Strategy

Camiel Janssen, Accenture Strategy

Nerjada Maksutaj, Accenture Strategy and World Economic Forum Seconded

Roland Schoonbeek, Accenture Strategy

Shishir Shroff, Accenture Strategy, Value Expert

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World Economic Forum
91–93 route de la Capite
CH-1223 Cologny/Geneva
Switzerland

Tel.: +41 (0) 22 869 1212
Fax: +41 (0) 22 786 2744

contact@weforum.org
www.weforum.org