Global Report 2015
A business, financial and sustainability overview
4. Global operations and innovation

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4.1 Amadeus Global Operations

Amadeus Global Operations is responsible for managing and delivering services to our customers. It receives services software from Amadeus Research & Development (R&D) and transforms it into systems, databases and networks for airlines, travel agents and travellers, with the purpose of facilitating travel-related operations and transactions.

The work of Global Operations starts with testing the applications to ensure that they function in a live context. It then builds and manages the necessary data centres, server systems, data storage units and communication networks. Finally, it ensures that continuous high-performance services are delivered to customers 24/7.

There are many critical elements to Amadeus’ business success; central among these are operational efficiency and security. These form the core framework that guides IT delivery activities at all levels, from data centre building to final service delivery.

Amadeus Data Centre operations

The Amadeus Data Centre in Germany was designed by engineers with extensive experience in establishing commercial data centres. Ownership of the facility provides Amadeus with full control of the physical environment and removes any reliance on third parties for security and data protection matters. Additionally, that optimises the efficiency of our development organisation, not only through integrated processes and tools but also through the flexibility it allows and the dedicated support we can give to new, creative solutions.

More than two decades of experience running a first-class data centre, coupled with a strong commitment to investment in the latest technology, progressive automation, and adaptation to international and industry standards, keeps Amadeus ahead of the curve. Today, thousands of travel providers rely on the systems hosted and maintained at the data centre facility to deliver over 3.9 million travel-related bookings on peak days. The facility also hosts and manages passenger service and departure control systems for more than 100 airlines, as well as numerous other IT solutions for travel management companies, hotel companies and many other players through the travel and tourism industry.

Amadeus’ solutions are offered in a Software-as-a-Service (SaaS) model, hosted primarily on open systems and highly scalable hardware on more than 11,000 servers at the facility. The Amadeus Data Centre is one of the largest data processing centres devoted to the travel industry, dedicated to providing customers with continued service excellence.

39,000+ transactions\(^2\) per second (peak)

3.9+ million net bookings per day (peak)

37+ petabytes\(^3\) storage

747 million passengers boarded
Business growth

Across all IT sectors, increasing customer demand for data has led to rapid and ongoing growth in IT system capacity.

Two decades ago a travel agent may have received approximately 20 requests for a single booking, whereas today an online travel agency might receive thousands of ‘hits’ per booking. This inflation in demand has resulted in exponential growth in data processing and data storage requirements at the Amadeus Data Centre.

Green IT and energy efficiency

In response to this growth in demand for data storage capacity, Amadeus has been focusing on the energy efficiency of all its operations. We received Energy-Efficient Enterprise certification from TÜV Süd in March 2010 (the certification was renewed in 2012 and in 2015) for the Data Centre power supply, cooling and climate control processes and IT equipment, as well as for the Centre’s procurement, installation and de-installation procedures. Our efforts have also resulted in the continued reduction of the annual Power Usage Effectiveness (PUE) ratio from 1.49 in 2009, when this value first began to be closely monitored, to 1.35 in 2015 (see graphic on the right). The latest Uptime Institute4 survey places the average PUE values for data centres at 1.7.

Global presence

Amadeus Global Operations is based on a Follow-the-sun model, with specialist support groups in Germany, the US, Australia, India and the United Kingdom. The Global Operations sites are the first points of contact for customers during business hours, strategically located in different time zones so that 24-hour service is guaranteed. This ensures optimal customer support from the closest available office and facilitates maintenance during off-hours.

Our global operations are supported by approximately 800 employees from more than 45 nationalities.

LEAN management

In 2015, Global Operations launched a LEAN management programme. The core concepts of LEAN, including customer-centric, data-driven decision making, will ensure that Global Operations continues to increase its focus on customer needs and customer value. The programme will also foster employee empowerment and delegation, to facilitate rapid decision making across all levels of Amadeus’ organisation.

Data Centre energy efficiency in PUE

Global Operations – technical evolution

Amadeus is moving swiftly into the era of cloud technology, based on open systems and virtualisation of both system technology and application architecture. This ‘cloudification’ will enable Amadeus to increase operational effectiveness of the end-to-end service delivery chain, from the developer desktop to the running production system. The cloud model is also enabling Amadeus Global Operations to start implementing services for customers reliably and securely in remote locations.

Amadeus Global Operations is continuing to move into open source operating systems. With the transition from proprietary systems to Linux in its final stages, we now see Altéa Reservations, Inventory and Departure Control systems running almost completely on open systems. The move to open systems is the basis for the creation of a ‘software-defined data centre’.

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4 The Uptime Institute Journal was founded in 2013 to promote thought leadership, innovation and proven methodologies of various disciplines and professions within the global data centre industry. The average PUE of 1.7 corresponds to a survey carried out in 2014 among 1,000 data centre operators and IT practitioners across the world.

See ‘Environmental sustainability’, p. 69.

Security

Amadeus continuously reviews and improves its processes to keep ahead of upcoming threats, ensuring that both people and technical factors are considered and addressed.

From a data centre and technology perspective, Amadeus has established an independent security operations centre to monitor the security status of the services it provides to customers 24/7. This service also helps us to understand emerging technical threats and invest in the most appropriate technology to mitigate new risks.

Internal Global Business Services: 500 people dedicated to enhancing Amadeus’ operational effectiveness

The Amadeus Global Business Services team works closely with internal business partners to design and deliver services to transform, automate and manage key business processes. Our Global Business Services unit comprises over 500 people spread across 35 countries. This unit is focused on the following service lines:

1. Business Consulting involves working with different departments to accelerate the strategic execution of business processes.
2. Workplace and Collaboration reinforces the coordination and sharing of knowledge to enable effective teamwork across the company.
3. Business Process Automation and Information Management aims to improve day-to-day efficiency.
4. Customer-Facing Services is dedicated to effective billing and collection to secure and optimise Amadeus’ revenue, cost of sales and collection.

Amadeus Corporate Information Security Office Programme

<table>
<thead>
<tr>
<th>Access Control</th>
<th>Ensure that only authorised persons have access to confidential information on a need-to-know and need-to-handle basis.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSDLC*</td>
<td>Ensure the implementation of secure software development methodologies according to SSDLC standards.</td>
</tr>
<tr>
<td>Data leak prevention</td>
<td>Assure that critical information in any format does not leak out to unauthorised persons/destinations.</td>
</tr>
<tr>
<td>Security awareness</td>
<td>Create employee awareness of enterprise security policies and build a culture in which employees are willing and able to follow them.</td>
</tr>
<tr>
<td>Regional security offices</td>
<td>Extend security awareness and control to all Amadeus regions and subsidiaries.</td>
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</tbody>
</table>
| Security Operations Centre | Ensures that:  
  _ All security policies and security architecture standards are properly monitored and controlled  
  _ Amadeus is fully protected against known threats and attacks  
  _ Security incidents are handled with proper communication  
  _ Security incidents are investigated and contained |
| Security architecture standardisation | Assure that we have technical security standards and rules for the development cycle, internal services and operations. |
| ISO 27001 certification | ISO 27001 certification level 3 for Amadeus Data Processing.                                                          |
| PCI-DSS* compliance | Assure that Amadeus is PCI-DSS compliant and that we are prepared for changes in PCI-DSS compliance requirements. |
| Security policy re-design | Assure security policies cover the full scope, are understandable and implementable.                                   |


4.2 Research, development and innovation

Amadeus Research & Development (R&D) has the responsibility of building innovative solutions for our customers worldwide. These solutions are based on a wide range of state-of-the-art components integrated for the specific needs of customers. R&D is a strategic priority for Amadeus, a key factor in achieving market leadership and sustainable, profitable growth.

Amadeus R&D places a special emphasis on the reliability and quality of its systems, products and services. This is a permanent objective, as R&D teams conceive, design, develop and maintain some of the world's most complex, widely available, real-time information systems, accessed daily by hundreds of thousands of travel professionals and end users in almost all areas of the travel industry.

Amadeus ranked as the leading R&D investor in the travel and tourism industry in the 2015 EU Industrial R&D Investment Scoreboard.5

Amadeus R&D investment (including capitalised R&D*)

R&D investment (figures in € million)
Percentage of revenue

* A part of our R&D costs is linked to activities that are subject to capitalisation, thus impacting the level of operating expenses that are capitalised on the balance sheet.

5 The EU Industrial R&D Investment Scoreboard contains economic and financial data for the world's top 2,500 companies, ranked by investments in research and development. For more information, visit www.iri.jrc.ec.europa.eu/scoreboard15.html.
A global approach

Amadeus’ R&D investment is supported by a network of 19 R&D centres across the world. Nice (France) is the largest centre for R&D activities, with on-site and global teams developing solutions for travel distribution, e-commerce, travel agency points-of-sale, airlines, hotels, railway companies, airport IT and travel intelligence. This R&D network is deployed regionally using a model of hubs, with global coverage and transversal activities. It employs satellites dedicated to specific applications and domains or, in some cases, support for customer projects. All sites work closely together, and teams for a project can be distributed among various sites. In 2015, two R&D sites were added in Singapore and Orlando (US), following the integration of companies acquired in the area of Airport IT.

Recruitment at Amadeus R&D is oriented towards incorporating a wide range of expertise and international culture in order to develop global products. Staff mobility, short- or long-term, is encouraged. Amadeus also offers numerous internships to top international schools, with formal recognition of their contribution in the form of an annual intern contest.

Amadeus pays particular attention to providing staff with a stimulating environment that enhances creativity and helps spark innovative ideas, promoting teamwork and staff interaction in a way that reflects its core values. In 2015, Amadeus completed the transfer of a large product and business division to a new site in the Nice area, featuring a collaborative office design in line with the generalisation of agile development methodology.

We also promote a culture of innovation across all R&D teams, with the objective of encouraging new ideas and prototyping the internal R&D research lab through contests (hackathons, participation in major tradeshows, competitions and so on).

Travel Crunch, Nice 2015. More than 180 contestants participated in the Travel Crunch. Employees from Nice, Bangalore and London came together to brainstorm, refine, prototype and pitch the R&D project they had originally submitted to the dedicated site, Open Ideas.

See ‘Corporate profile’, p. 12.
See ‘Environmental sustainability’, p. 73.
See ‘Amadeus people’, p. 103.
Amadeus has 19 R&D centres across the globe:

- **Aachen**: Leisure distribution systems (Traveltainment)
- **Antwerp**: Mid-office for travel agencies
- **Bangalore**: Development centre for mobile and some central applications
- **Bangkok**: Regional development centre for Asia-Pacific
- **Bogotá**: Regional development centre for Latin America
- **Boston**: Development centre for North America and some central applications
- **Frankfurt**: Leisure and mid-office for Germany
- **Istanbul**: Airline loyalty and e-commerce travel agencies
- **London**: Airline Departure Control
- **Madrid**: Travel payment solutions
- **Miami**: Regional development centre for North America
- **Nice**: Central sites – all applications and methods
- **Orlando**: Airport management systems
- **Portsmouth**: Hotel sales and catering (Newmarket)
- **Singapore**: Airport management systems
- **Strasbourg**: Travel agency mid-office for France
- **Sydney**: Airline Altéa and regional support airlines
- **Tucson**: Airline Revenue Integrity
- **Warsaw**: Regional development centre for Asia-Pacific
In 2015, Amadeus R&D teams continued the implementation of a more agile development methodology for core applications and major customer projects. The agile program aims to leverage the deployment of common methodology and tools for software programming, quality assurance and, more generally, for all phases of the product development cycle across all development centres. Amadeus continuously seeks to apply developing technologies to innovate in the field of travel. Our goal of shaping the future of travel is pursued in five strategic areas:

Cloud-based architecture
This includes the design, architecture and operation of applications capable of running using standardised, low-cost, low-consumption hardware, potentially distributed across multiple data centres. The core concepts are based on redundancy and isolation of platforms. This is a general trend in the industry, led by the largest IT companies.

In 2015, Amadeus made substantial progress in both the areas of operational infrastructure and technical architecture. These initiatives are grouped under the Amadeus Cloud Services programme, which includes the containerisation of existing and new applications, the automation of operational processes and the support of Ultra High Availability for critical systems. An initial deployment of the Amadeus Cloud Services programme was carried out in 2015 with the Distributed Availability platform, in co-operation with Lufthansa and Google.<ref>See 'IT Solutions', p. 29.</ref>

Security
Security is at the heart of Amadeus’ systems in terms of application design and operations. Security of data is ensured by advanced techniques, including sophisticated methods of encryption for critical data. In 2015, the compliance of Amadeus’ systems was upgraded to the new PCI-DSS v3.1<sup>6</sup> security standards.

Massive data
The technical capability of handling extremely large volumes of data has been highlighted by travel providers as a key factor in drastically improving their service to customers and optimising their operations. Travel providers (airlines, hotels, etc) are clearly moving toward contextual searching, where product price and availability is based on the exploitation of data such as trip history, customer ranking and a holistic view of the trip, as well as on the identification of the requester and traveller, in order to dynamically create the best-suited result. This makes it possible to provide enhanced contextual services and customised offers. In 2015, Amadeus released applications powered by massive data processing in the fields of travel search, merchandising and advertising, leveraging tools such as NoSQL databases and grid-based distributed data clusters (Hadoop).

In 2015, the Amadeus Travel Intelligence unit enhanced the design of its data management framework to improve scalability and integrate the latest technology in machine learning, data processing and visualisation techniques. Data mining is a promising source of optimisation for travel providers because it powers decision systems, dynamically adapting functionality to the environment. Amadeus puts a particular focus on real-time analytics and invests in advanced and non-conventional database techniques to innovate in this field.

Mobile
Today more than ever before, travellers are enjoying the convenience of mobile devices for arranging and controlling travel. Amadeus has always been active in this field and continues to invest in new forms of user interaction, including voice recognition and wearable technology. With its central architecture, Amadeus can provide the traveller with ubiquitous access to data and transactions, irrespective of the channel used. In 2015, Amadeus continued the implementation of its digital multi-channel platform, aimed at making the traveller’s experience as smooth as possible by providing essential services at every step of the trip (for example, the Amadeus Personal Disruption Companion). Amadeus has also begun to investigate the business and technical implications of connected objects (Internet Of Things).

For the particular areas highlighted above, but also generally in terms of functional improvements developed in our applications, Amadeus is strongly committed to bringing innovation to its customers, and to the travellers they serve.<ref>See 'Travel Intelligence', p. 40.</ref> <ref>See 'Mobile', p. 43.</ref>

<sup>6</sup> The Payment Card Industry Data Security Standard (PCI-DSS) is a proprietary information security standard for organisations that handle branded credit cards from the major card brands. Mandated by the card brands and run by the Payment Card Industry Security Standards Council, the standard was created to increase controls around cardholder data to reduce credit card fraud.
World-class technology

Our architecture is based on distributed open systems offering particular advantages, such as:

- Extremely high-performance transaction processing under stringent system availability, security and dependability requirements
- The management of very large databases with full transactional integrity
- Rapid response time for all functions from any point of access in the world
- Multi-channel customer servicing applications such as agent desktops, websites, kiosks, mobiles, tablets, as well as increasing programming access (Web Services API7) for fast integration in external systems and websites
- Hundreds of thousands of concurrent professional users (and a greater number of end consumers) with system access via a wide range of devices and methods
- A large base of diverse customers, all served from a single set of community applications
- A wide range of applications and functions for both Distribution and IT Solutions
- The capability of maintaining and evolving all applications and system software while they run

This modern architecture is continuing its global migration to open source software, allowing Amadeus to move away from proprietary software and hardware and benefit from the latest technological innovations in the IT industry. Amadeus uses a combination of intellectual property (IP) rights (notably copyright, know-how, patents, trademarks and domain names) and appropriate IP provisions in transactional agreements to protect its innovations. Sometimes, Amadeus contributes to the development of open source communities by licensing some of these intellectual property rights to selected open source projects.

True partnership with the travel industry

When Amadeus was founded in 1987, the decision was made to base the company’s architecture and software development model on a partnership approach, with two major objectives:

1. Airlines and travel agencies sharing the same core reservation functionality. The system user concept promotes substantial synergies in the development of applications, and allows the airline and the travel agency’s direct channels to share common processes, practices and data, avoiding complex synchronisation of systems. This is extremely important for the convenience of travellers, who are served by both airlines and travel agencies, and can benefit from a single view of their trip.

2. Amadeus serving a wide range of travel sector customers from a common core architecture, adapting and customising to each customer as required. This approach is essential to evolving Amadeus’ system to the global requirements of the industry, rather than to individual customers. As a result, Amadeus is in a strong position to anticipate the major developments in travel and address the real needs of travel players through innovation. In other words, Amadeus works for the travel industry through joint collaboration with its customers and partners.

These decisions were instrumental in giving us an advantage over our competitors in the past, and continue to do so today. Thanks to the synergetic architecture of Amadeus Distribution and IT Solutions, our technology is able to serve all distribution channels. In 2015, this approach was successfully pursued in the area of travel search and merchandising, benefiting our customers, both airlines and travel agencies, and as well as the upcoming Amadeus’ travel intelligence platform.

API refers to ‘Application Programming Interface’. It is the language that enables communication between computer programs.

See ‘Travel Intelligence’, p. 40.
4.3 Amadeus travel reports and research papers

In 2015, Amadeus continued to lead in research and innovation by commissioning and publishing research papers that facilitate debate about important trends in the industry.

Future Traveller Tribes 2030

Future Traveller Tribes 2030, which follows the 2014 report Shaping the future of travel: Macro trends driving industry growth over the next decade, seeks to understand how ‘the traveller’ is evolving – and will continue to evolve – over the next 15 years. The basic premise is simple: if we can understand what motivates travellers in the future, from their buying decisions to personalisation requirements, we can help our customers to better shape their solutions, products and services, both now and in the coming years.

Understanding Tomorrow’s Traveller

This study, prepared by Future Foundation, identifies the different ‘tribes’ – or traveller segments – that will shape the future of travel till the end of the next decade. Future Foundation moved beyond demographic-based segmentation, taking a rigorous psychographic approach that draws on traditional labels as well as on travellers’ personality traits, values, interests and lifestyles.

Building a More Rewarding Journey

Developed by Frost & Sullivan, this report seeks to build on the previous and answer the critical question of how purchasing habits will evolve, and how the airline industry can respond to these emerging traveller behaviours to build a more rewarding and connected journey.

Streamlining Airline Financial Processes

This report reviews the lessons that the airline industry can learn from other industries, such as retail and banking. It highlights how airlines can boost their top and bottom line by integrating financial processes, increasing automation and exploiting predictive analytics.

Safeguarding Information Systems

This report brings together analyses, expert contributions and real-world examples to offer a comprehensive overview of data care, the rising impact of fraud and the industry’s response to it.

Business Travel in Asia-Pacific: Setting the Smart Course

Travel is often among the largest controllable expenses for companies. This report outlines the steps companies can take to develop the most efficient travel programme for their employees.

Influencing Travelers in the New Digital Funnel

Amadeus co-sponsored this White Paper with Phocuswright to investigate how online shoppers research and book their vacations. The research unlocks opportunities for online travel retailers to target, influence and monetise travellers’ shopping behaviour.