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An Exploratory Study on Sustainable ICT Capability in the Travel and Tourism Industry: The Case of a Global Distribution System Provider

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Abstract:

Climate change is one of the biggest challenges facing humanity today. Environmental values have spread globally and consumer beliefs are pressurizing firms in almost all industries to comply with green regulations. Sustainability has become such an important part of business strategy that almost every major company now has an executive with “sustainability” in their title. The travel and tourism industry produced 14 percent of global greenhouse gas emissions in 2010. Policy makers have responded with ambitious targets. The European Union aims to achieve a 60 percent reduction in transport sector emissions by 2050. This exploratory study draws on the sustainable ICT capability maturity framework (SICT-CMF) and the case of the Amadeus IT Group, a large travel and tourism industry corporate enterprise that specializes in IT solutions. The study investigates the current capability maturity level of sustainable ICT in the company. The findings suggest that the company is a market leader in terms of sustainability initiatives and that it demonstrates an “advanced” level of sustainability capability. We discuss the lessons learned from Amadeus’ experience.

Keywords: Sustainable ICT-Capability Maturity Framework, Strategy, Travel and Tourism Industry.

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1 Introduction

In the last few years, environmental values have spread globally and consumer beliefs are pressurizing firms in almost all industries to comply with green regulations. Environmental concerns are compelling businesses to complement their primary focus on serving customers with addressing issues of sustainability (Watson, Lind, Haraldson, 2012; Gholami, Watson, Hasan, Molla, & Anderson, 2016; Gholami, Goswami, Molla, & Brewster, forthcoming; Anon, Gholami, & Shirazi, 2017). In order to differentiate themselves in a globally competitive market, companies are looking to develop their green reputation (Amadeus IT Group, 2011). Hall, Daneke, and Lenox (2010) note that “sustainability” has become such an important part of business strategy that almost every major company now has an executive with “sustainability” in their title.

This paper focuses on the efforts of one such company in the travel and tourism industry. For businesses in this industry, a positive green reputation is an extremely important aspiration. Overall, the travel and tourism industry produced 14 percent of global greenhouse gas emissions in 2010 (United States Environmental Protection Agency, 2017). Policy makers have responded with ambitious targets. For example, the European Union (EU) aims to achieve a 60 percent reduction in transport sector emissions by 2050 (European Commission, 2009). At the same time, travelers are increasingly looking for environmentally neutral travel experiences. A report by the Amadeus IT Group on key consumer groups identified “ethical travelers” as a possibly important future demographic customer segment for the travel and tourism industry (Amadeus, 2015). This market segment tends to be extremely conscious of their impact on society and the environment and is keen on travelling in moderation, supporting environmentally friendly businesses, and availing services such as carbon offsetting.

Information and communication technologies (ICT) can potentially play a crucial role in companies’ sustainability and green agendas. Reports suggest that, by 2020, the enhanced use of ICT could decrease total global greenhouse gas emissions by 15 percent (Climate Group, 2008). Information systems (IS) have been a major contributor to economic growth and productivity over the last two decades (Devaraj & Kohli, 2000; Stroh, 2002; Dedrick, Gurbaxani, & Kraemer, 2003; Barua et al., 2010). With particular reference to sustainability in travel and tourism, ICT have the potential to make supply chains, operations, buildings, and grids smarter and cleaner. IS solutions can result in reduced fuel consumption and optimized movement of people and goods. In the case of global aviation, ICT can provide instant access to GPS information for planes and could enable one to modify flight plans on the fly to use the least amount of fuel. They can improve airports’ communication with planes and increase the efficiency of waiting ground crews (Initiative for Global Environmental Leadership, 2014). ICT devices such as smartphones provide customers the opportunity to check buses’ location in real time and book travel appointments. Similarly, real-time traffic information can reduce congestion and dynamic pricing for road use and parking can make transport more efficient (Initiative for Global Environmental Leadership, 2014). Big data solutions enable businesses to make better predictions about market trends and travel plans of customers. Big data solutions and the Internet of things could also eliminate inefficiencies in freight rail operations to save US\$27 billion over 15 years, and capital expenditure on oil and gas exploration could be reduced by US\$90 billion (Initiative for Global Environmental Leadership, 2014). For companies, implementing a sustainable ICT strategy can deliver other economic, social, legal, and political benefits as well. It can help them record the positive impact of their green initiatives, better respond to regulatory changes, and bring consistency in green practices across the enterprise. It can also improve staff members’ awareness about key social and environmental issues (Campbell, 2007).

This paper explores Amadeus IT Group’s (which we simply refer to as Amadeus henceforth) sustainable ICT strategy. Amadeus is a major global player in the travel and tourism industry. It is a large corporate enterprise that specializes in IT solutions and participates in the travel experience of close to two million passengers every day. The paper addresses two questions: 1) “What are the achievements of Amadeus’ sustainable ICT strategy implementation?” and “What lessons follow from Amadeus’ experience of sustainability initiatives?”. The paper provides actionable insights into how companies can improve the maturity of their sustainable ICT capabilities. It illustrates a set of best practice IT solutions that are fundamental to achieving environmental sustainability for global organizations, especially in the travel and tourism industry. It also highlights the crucial role of building an organizational culture that buys into the benefits of sustainability initiatives.

This paper proceeds as follows: in Section 2, we review sustainable ICT maturity models with a particular focus on the sustainable ICT capability maturity framework (SICT-CMF). In Section 3, we discuss the

research methods we used and, in Section 4, describe the Amadeus case. In Section 5, we discuss Amadeus' sustainable ICT strategy in light of the SICT-CMF model. Finally, in Section 6, we discuss the lessons learned from Amadeus' experience.

2 A Framework for Sustainable ICT Strategy and Implementation

Typically, successful sustainability strategies involve adopting an integrated framework along the value chain that covers three main areas: 1) preparing and planning for sustainability as a core component of the business strategy; 2) implementing sustainability initiatives by moving towards sustainable energy, sustainable products, or services and sustainable processes; and 3) clearly and effectively communicating and promoting sustainability initiatives and their benefits to all stakeholders along the value chain (Sarkar, 2012). Recent scholarship has developed various models that explore and assess the maturity levels of sustainable ICT strategies and their implementation. They include the G-readiness framework that Molla and Cooper (2009) and Molla, Cooper, and Pittayachawan (2011) developed, the green IT capability maturity model (Philipson, 2010) that Fujitsu used for a global survey (Fujitsu, 2010; Rowe, 2011), the green IT maturity assessment program (Accenture, 2010), the green ICT scorecard that CIO/CTO Council of the UK designed (McGregor, 2008), and the U.K. Government green ICT maturity model (HMG CIO Council Green ICT Delivery Unit, 2012). In 2008, in collaboration with an industry consortium (including Intel, Microsoft, SAP, Chevron, Cisco and Fujitsu), Ireland's Innovation Value Institute developed the sustainable ICT capability maturity framework (SICT-CMF) to systematically assess and improve sustainable ICT capabilities (Donnellan, Sheridan, & Curry, 2011; Curry, Guyon, Sheridan, & Donnellan, 2012). The SICT-CMF is the most well-known and widely used framework for analyzing firms' sustainable ICT capability. The SICT-CMF enables firms to measure their current maturity level and implement a set of practices to increase their SICT capability level (Curry & Donnellan, 2012). In other words, the framework helps firms identify and assess capability gaps and provides opportunities to improve their SICT performance (Curry & Donnellan, 2012).

The sustainable ICT capability maturity framework comprises four categories: 1) strategy and planning (which includes the specific objectives of sustainable ICT and its alignment with the organization's overall sustainability strategy), 2) process management (which includes the sourcing, operation, and disposal of ICT and the provision of systems based on sustainability objectives and the reporting of performance), 3) people and culture (which defines a common language to improve communication throughout the enterprise and establishes activities to help embed sustainability principles across the enterprise), and 4) governance (which develops common and consistent policies and requires accountability and compliance with relevant regulation and legislation) (Curry & Donnellan, 2012) (see Table 1).

Table 1. Four Categories of Sustainable ICT (Curry & Donnellan, 2012)

Category	Description
Strategy & planning	This category includes the specific objectives of sustainable ICT and its alignment with the organization's overall sustainability strategy.
Process management	This category includes the sourcing, operation and disposal of ICT, as well as the provision of systems based on sustainability objectives and the reporting of performance.
People and culture	This category defines a common language to improve communication throughout the enterprise and establishes activities to help embed sustainability principles across the enterprise.
Governance	This category develops common and consistent policies and requires accountability and compliance with relevant regulation and legislation.

The framework also defines a five-level maturity curve for identifying and developing sustainable ICT capabilities (see Table 2). It helps assess a company's status with regards to each category. The assessment methodology typically draws on interviews with IT and business managers and staff members involved with corporate social responsibility (CSR) initiatives in order to understand their assessment of the maturity level and importance of sustainable ICT capabilities in the firm. The assessment can provide valuable insights into a company's sustainable ICT capabilities and how key stakeholders and staff members view both the importance and maturity of capabilities. In Section 5, we apply this framework to explore and assess the sustainable ICT capabilities of Amadeus, a leading player in the global travel and tourism industry.

Table 2. The Sustainable ICT Capability Maturity Framework (Curry et al., 2012)

Maturity level	Strategy and planning	Process management	People and culture	Governance
5. Optimizing	<ul style="list-style-type: none"> Stakeholders across extended enterprise acknowledge sustainability as a success factor in driving business strategy CEO leverages sustainability as business differentiator 	<ul style="list-style-type: none"> Integration of sustainability for ICT-enabled processes and ICT system management across extended enterprise and tracking scorecard Best practices drive industry and thought leadership on sustainability 	<ul style="list-style-type: none"> Common language adopted across extended enterprise Sustainability is a core value and organization is recognized for thought leadership CEO accountable for branding and image 	<ul style="list-style-type: none"> Driving international standards and legislation Pervasive influence Innovation of policies and adoption across extended enterprise
4. Advanced	<ul style="list-style-type: none"> Sustainability is a core part of ICT and business planning cycle Senior management led enterprise-wide sustainability metrics 	<ul style="list-style-type: none"> ICT and business role incentives aligned to impact and success for sustainability across the enterprise Staff members mentoring/skills focus Best practice recognized 	<ul style="list-style-type: none"> ICT and business role incentives aligned to impact and success for sustainability across the enterprise Staff members mentoring/skills focus Best practice recognized 	<ul style="list-style-type: none"> Enterprise compliance with policies is a core business accountability Regulations and policies updated with best practice developed to exceed targets
3. Intermediate	<ul style="list-style-type: none"> ICT sustainability strategy and execution plans in place and integrated across prioritized ICT programs Some business metrics defined and used where local opportunities arise 	<ul style="list-style-type: none"> ICT policies standardized to source and dispose of ICT assets against defined metrics Design of ICT systems prioritizes sustainability targets ICT performance and reporting is tracked on a project-by-project basis 	<ul style="list-style-type: none"> Capability/skills development key asset for staff members' development Staff members encouraged to contribute to sustainability programs and visibility ICT has adopted common language with limited business adoption 	<ul style="list-style-type: none"> Common policies and accountabilities documented and applied to all ICT initiatives Business accountability with limited adoption of best practices
2. Basic	<ul style="list-style-type: none"> Limited sustainability, strategy planning, and execution Where visible, approach and metrics are inconsistent 	<ul style="list-style-type: none"> Basic reactive sourcing; disposal based on local policy Sustainability not integrated into ICT thinking Reactive approach to SICT performance and reporting 	<ul style="list-style-type: none"> Common language defined and limited use in ICT Increasing awareness within ICT of sustainability issues, but little coherence 	<ul style="list-style-type: none"> Common policies may exist with limited documentation and inconsistent adoption in the ICT organization Awareness of compliance but limited accountability to meet requirements
1. Initial	<ul style="list-style-type: none"> No ICT sustainability strategy, execution planning in place Any sustainability metrics are ad hoc and inconsistent 	<ul style="list-style-type: none"> Any attempt at the management of a sustainable life cycle is ad hoc ICT systems are not designed to meet sustainability metrics Little sustainability tracking or reporting 	<ul style="list-style-type: none"> No awareness of ICT-related sustainability issues or language No communications across the ICT organization and the business on sustainability issues 	<ul style="list-style-type: none"> Type and level of compliance unknown Any accountability or policies that exist are ad hoc

3 Methods

In this research, by drawing on the SICT-CMF for analyzing firms' sustainable ICT capability and adopting the qualitative case study approach (Mayasandra, Pan, & Myers, 2006; Sandeep & Ravishankar, 2014), we explore the sustainable ICT strategy and capability maturity level of Amadeus, a global multinational company in the travel and tourism industry. We drew on three main sources of data. First, we accessed

the 2014 and 2015 Amadeus' Global Reports, which provided valuable data about the sustainability journey of Amadeus and the challenges confronting the company's environmental initiatives. Second, we conducted telephone interviews with 28 Amadeus staff members (in Amadeus' Sophia-Antipolis office, which is one of the company's headquarters based in France) from its HR, marketing, engineering and finance units to explore their awareness and attitude towards the company's sustainable ICT strategy, their engagement with the initiatives, and their willingness to participate in implementing the sustainable ICT strategy in the firm (see Appendix).

We conducted the interviews in 2012, and they lasted on average between 30-60 minutes. We recorded and transcribed all the interviews. The interviews started with a quick introduction, which allowed the participants to understand the general purpose of the interview and the context of the study. The exploratory interview (in French and English) included open-ended questions about staff members' perceptions of the firm's drivers for developing sustainable ICT capability. Third, we consulted several secondary sources such as blogs, company websites, press articles, and social media outlets such as Twitter and Facebook, which provided more information about Amadeus' sustainability initiatives.

4 Case Description: Amadeus IT Group

Amadeus IT Group is a large corporate enterprise in the travel and tourism industry that provides specialized IT solutions. It is a multinational firm that offers "neutral" flight availability data that allows customers and travel agencies to easily book tickets online via its global central distribution system. It is also one of the world's three major global distribution system providers (besides Sabre and Travelport). Amadeus was established in 1987 through an agreement between Air France, Lufthansa, Iberia, and SAS with the intention of creating a global distribution system (GDS), a company with the prospect of becoming a European competitor to the large American reservation company, Sabre. The four European airlines merged their individual reservation systems into one system. Currently, Amadeus collaborates with 706 airlines, 44 cruise and ferry lines, 44 car rental companies, 90 rail operators, 18 insurance companies, and 248 tour operators, among others. The company has over 14,000 employees across 195 countries (Amadeus IT Group, 2015). Through the Amadeus website customers can book train travel, cruises, car rental, ferry reservations, and hotel rooms. Figure 1 presents a brief history of Amadeus IT Group and Table 3 reviews Amadeus' 2014 revenues, operating income, and margins relative to its two main competitors (Cowen, 2015).

Amadeus has gradually diversified its solutions and services and now provides IT solutions to other businesses in the travel industry, including airports, hotels, and railway companies. For instance, it provides new generation departure control systems to airlines. It also offers solutions that enable the integration of air and rail in order to tackle the challenges of costly fragmented transport industry in Europe (Amadeus Global Report, 2014b). For example, the company's IT2Rail and the Innovation Program4 of the Shift2Rail work is designed to transform a series of silo markets into one single integrated multimodal market for transport industry across the European Union (Amadeus Global Report, 2014b). Below, we describe the sustainable ICT program at Amadeus IT Group under each of the four categories of Curry and Donnellan's (2012) sustainable ICT capability maturity framework (SICT-CMF).

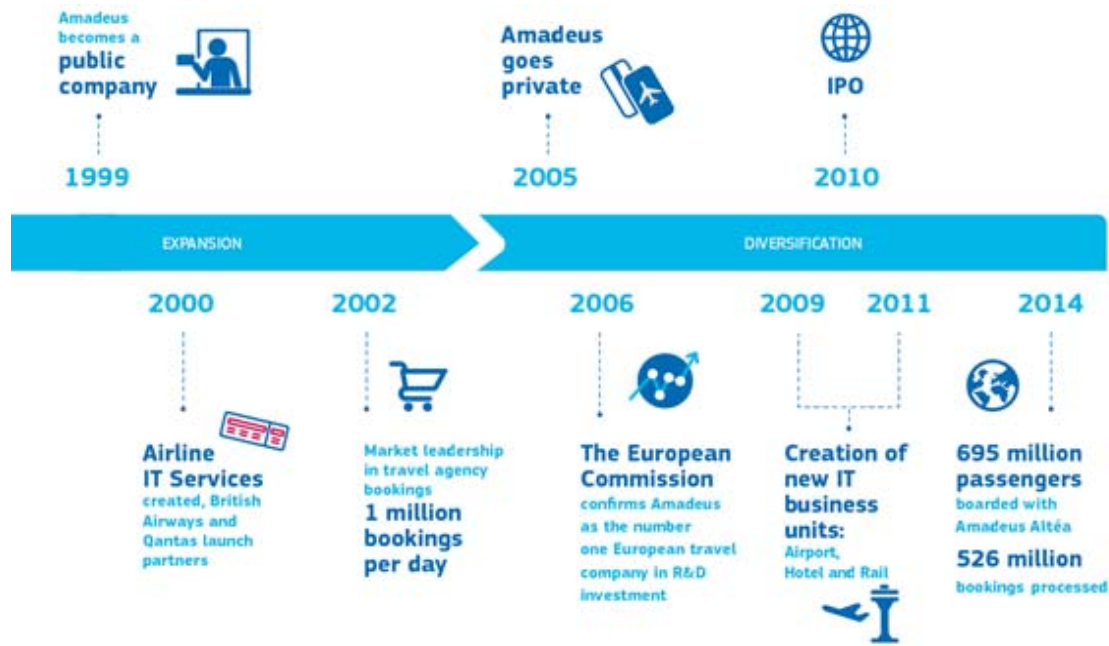


Figure 1. Amadeus History (Amadeus IT Global, 2014b)

Table 3. Revenues, Operating Income (EBITDAs), and Margins in 2014 (in USD) (Cowen, 2015)

	Sabre	Travelport	Amadeus
Revenues	\$2,631m (total revs)	\$2,148m (net revs)	\$3,834m
EDITDA	\$840m (total, adjusted)	\$540m (adjusted)	\$1,464m
Margin	31.9%	25.1% (adjusted)	38.2%

5 Findings

5.1 SICT-CMF (Category 1) at Amadeus: Strategy and Planning

We found that Amadeus' sustainable ICT strategy and planning revolves around three pillars: 1) improving green operations and optimizing the environmental performance of operations, 2) offering environmentally friendly IT solutions for customers in order to help them achieve their environmental objectives and targets; and 3) proposing industry initiatives, which involve working with other stakeholders on common sustainability initiatives in the travel and tourism industry (see Figure 2 and Table 4).

The company aims to improve operational efficiency by reducing resource consumption and negative environmental impact. We found several records of improved operations and cost savings. For example, in the company's Erding Data Centre in Germany, the company has estimated that it has saved more than €1M per year against annual electricity costs of over €4M (Amadeus Global Report, 2014b). A standard environmental impact reporting method is challenging to design but increasingly crucial for firms in the travel and tourism industry since it helps customers obtain reliable and accurate information and improve their corporate sustainability performance. In partnership with the International Civil Aviation Organization (ICAO) and the Global Sustainable Tourism Council (GSTC), Amadeus has enabled standard environmental reporting for the travel and tourism industry besides offering solutions that improve business customers' productivity (Amadeus IT Group, 2014b, 2015).

For instance, Amadeus' Altéa Departure Control System reduces the amount of fuel used, emissions produced, and costs incurred for airlines through improved aircraft weight estimations (Amadeus IT Group, 2015). Amadeus also works with external stakeholders to address environmental challenges for the whole industry through various initiatives. For example, the company actively participates in travel and

tourism forums organized by the European Technology and Travel Services Association (ETTSA) and the Interactive Travel Services Association (ITSA). Also, as part of its sustainable ICT strategy, Amadeus fosters environmental awareness among passengers. For instance, the company has initiated a carbon offsetting initiative for its Japanese market. This project provides travelers information about CO2 emissions per trip and invites them to make a voluntary donation to invest in projects that reduce emissions by an amount equal to their CO2 emissions per trip figure (Amadeus Global Report, 2014b). Overall, it is evident that Amadeus' sustainable ICT strategy has been well planned and that it has delivered significant results since its implementation in 2009.

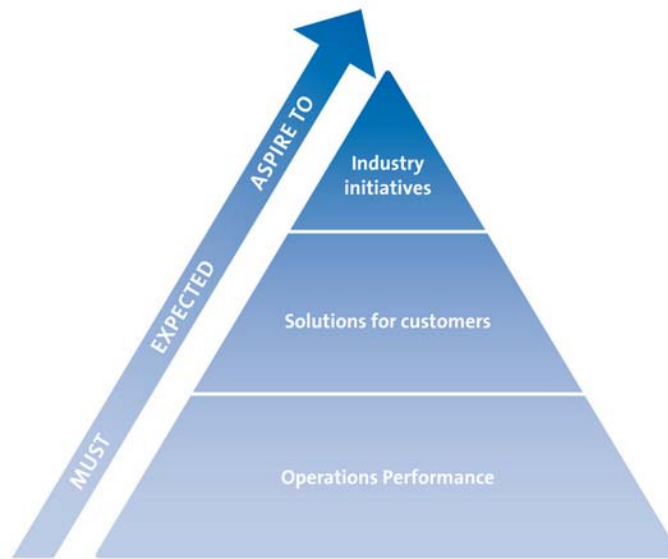


Figure 2. Sustainable ICT Strategy and Planning in Amadeus (Amadeus IT Group, 2015)

Table 4. Amadeus Stakeholders and Environment (Amadeus IT Group, 2012)

Stakeholders and environment	
Shareholders	A solid environmental plan across the organization is critical for living up to the excellence standards that are required to remain an attractive company.
Employees	Environmental commitment is appreciated by talented professionals and provides opportunities and comfort to all that share a concern over the environment.
Partners	Globalization and economic and demographic growth implies increasing pressure over natural resources and the environment in general.
Customers	Amadeus' sophisticated distribution and IT network and the existing relationships with a wide range of industry players offers Amadeus a privileged position to promote industry-standard environmental-related services.

5.2 SICT-CMF (Category 2) at Amadeus: Process Management

Amadeus has implemented a series of sustainable process management principles and practices in everyday actions and decision making. Our analysis showed that, in the main, process management activities at Amadeus take place in three broad areas: 1) the sourcing of sustainable ICT, 2) development of sustainable operations, and 3) end-of-life management.

5.2.1 The Sourcing of Sustainable ICT

This process involves implementing sustainable sourcing practices by deeply embedding environmental concerns into the company's ICT procurement choices. The process of sourcing sustainable ICT involves carefully assessing the energy usage and footprint of ICT hardware (e.g., data centers) and the energy rating of ICT equipment, analyzing suppliers' green image and initiatives (Rao & Holt, 2005), assessing products' "greenness" (e.g., wrapping, product lifespan, and recycling possibility), and performing social-ethical assessments of procurement (Molla, Peszynski, & Pittayachawan, 2008). Amadeus has faced increasing demand for green products from buyers and, hence, has implemented several green sourcing policies. To support its economic and environmental sustainability goals, it has implemented a "green procurement policy" whereby the environment is a key factor in all sourcing decision making processes.

Amadeus employees not only have to select suppliers who produce their goods and services in a sustainable manner but also need to attest to the true willingness of suppliers to comply with regulations and eco-standards. After systematically evaluating the power usage of products and considering their lifespan and recyclability, the procurement managers also evaluate the commitment level of suppliers to green practices and to preserving the environment. In line with the green procurement policy, the company has implemented new "environment care" projects that focus on reducing electricity consumption for cooling data centers and procuring sensors in offices to cut electricity usage. To assess developing energy needs, Amadeus periodically undertakes an organization-wide energy audit. Overall, Amadeus' sourcing of sustainable ICT equipment covers the evaluation of the sustainability of electronic supplies and their subsequent need (also see Molla et al., 2008). The company's sustainable ICT sourcing policies and practices helps it to comply with global green initiative standards to assess energy needs.

5.2.2 Development of Sustainable Operations

Amadeus' development of sustainable operations includes adopting sustainable practices, technologies, and systems. First, the company has adopted a range of virtualization practices as part of its commitment to develop sustainable operations. In simple terms, virtualization involves sharing hardware resources among the services and applications that use these resources. It has multiple benefits. It decreases the firm's carbon footprint as it can reduce paper usage by digitally sharing information. It supports long-distance communication and deters employees from unnecessary travel. For instance, data suggests that the use of videoconferencing and online banking has significantly reduced Amadeus' carbon footprint (e.g., the number of plane and car journeys undertaken) and tools that enable e-ticket generation has reduced paper usage, which has saved many trees. The company's overall energy consumption has also gone down significantly due to its sharing information via virtual websites such as Blackboards or Wiki, which, in turn, has diminished the need for hardware because multiple applications are run on the same computer. Amadeus also trains employees who want to be greener via e-learning. Available on their e-university website under topics such as "How to go eco with 5 school supplies", these useful sustainability tips can be implemented in day-to-day activities.

Significantly, Amadeus provides customers access to cutting-edge and environmentally friendly virtualization and cloud technologies. For example, in 2014, Amadeus implemented its Airport Common Use Service (ACUS)—a cloud-based software-as-a-service platform—at Austria's Innsbruck airport. ACUS is hosted centrally in an Amadeus data center and delivers significant savings to airlines through reduced ICT infrastructure, CO2 emissions, and energy consumption (Amadeus IT Group, 2015). Several airlines' applications are now hosted on ACUS cloud-based common use service, and high efficiencies have been recently reported (Amadeus Global Report, 2014b). ACUS enables one to access passenger processing systems anywhere in and outside the airport terminal, which facilitates agile, flexible, and scalable operations and reduces costs. In emergencies, ACUS ensures operational continuity at airports by increasing terminal capacity at check-in and transfers, by moving facilities to another location, and by putting ad hoc or mobile workstations in place (Amadeus IT Group, 2015) (see Figure 3). It also reduces energy consumption at airport buildings: recent figures show customer annual savings of 630 MWh in the use of equipment and peripherals (Amadeus IT Group, 2015).

Second, our empirical data showed that Amadeus has increasingly turned to sustainable practices in its document management systems. With a rapidly growing employee base, the company has strived hard to promote green printing practices and to reduce the amount of paper used. Its document-management systems include e-options for printers, which reduces paper usage and the extensive use of digital documents and, thus, allows more people to read material without the need to print multiple paper copies. Double-sided printing and the removal of cover pages by default have now been adopted as an

organization-wide policy. The company uses automated badge-based printing systems in most of its offices, which makes it possible to monitor the total amount of paper used and to regulate excessive use.

The company’s implementing a “FollowMe” printing system has enabled employees to send a document to any printer in the company offices and then walk to collect it. The system further provides employees online assessments of their paper consumption (Figure 4) to save trees by making employees think twice before sending the document to print. In a 2012 report, Amadeus hoped to cut its total paper consumption by 40 percent (Amadeus IT Group, 2012).

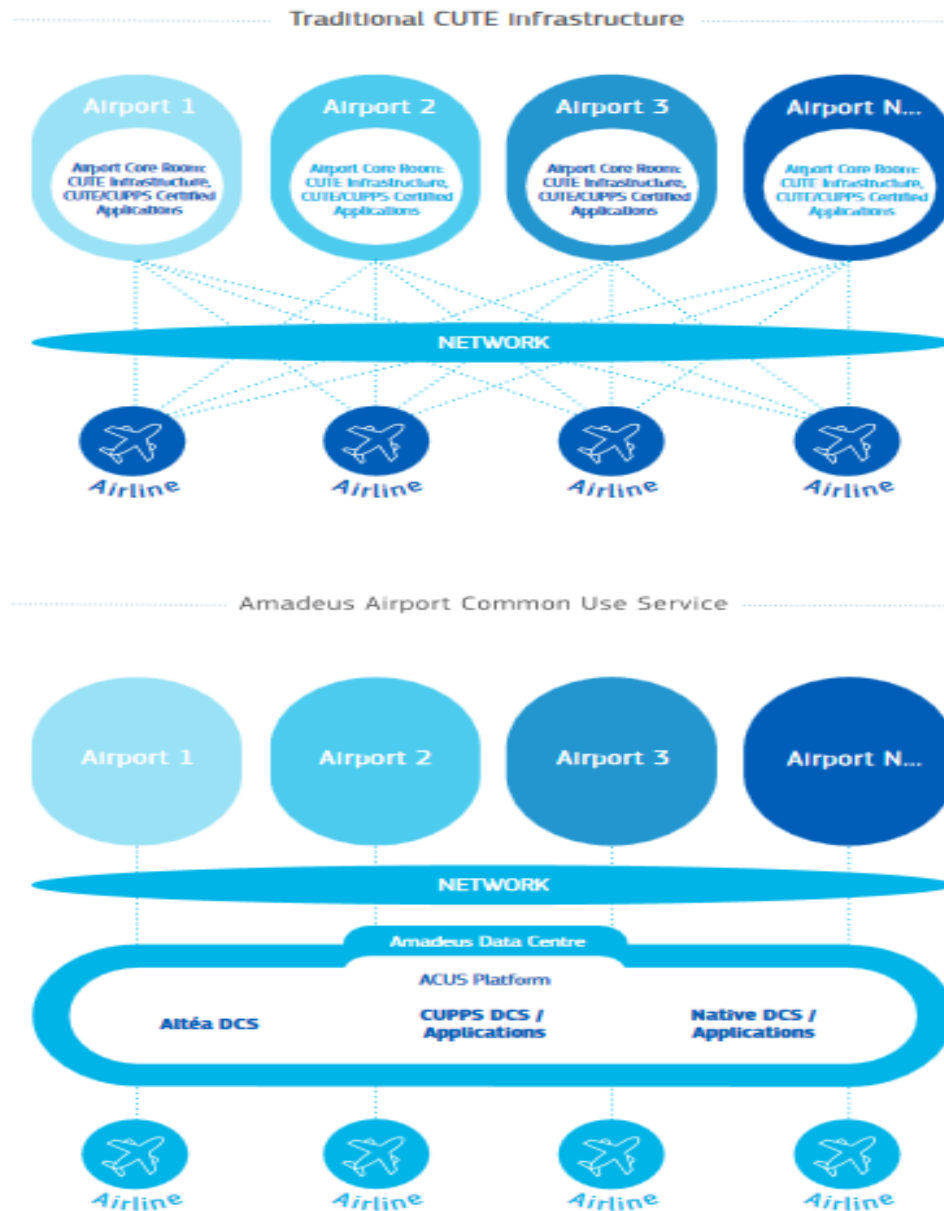


Figure 3. Traditional Common Use Terminal Systems (CUTE) Infrastructure versus Amadeus ACUS (Amadeus IT Group, 2014a; Amadeus IT Group, 2015)

In 2010, the company’s top 10 sites consumed over 82,090kg of paper: each employee consumed 11.3kg of paper. By 2014, this consumption fell to 52,620kg: each employee consumed only 6.1kg of paper—a reduction of 46.1 percent in overall consumption of paper per employee (Amadeus, n.d.).

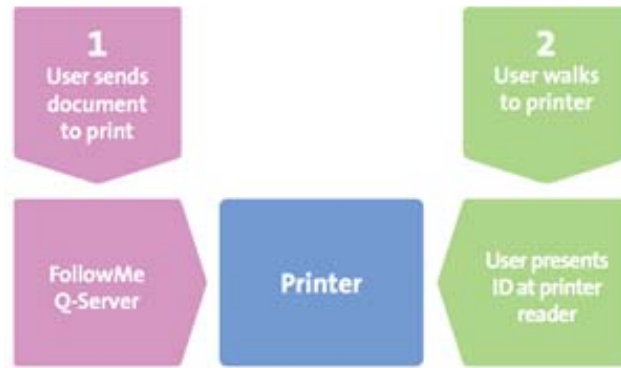


Figure 4. Green Printing with FollowMe (Amadeus IT Group, 2014)

Third, Amadeus has implemented several specialized information systems to facilitate reporting and forecasting. Several recent travel and tourism industry white papers indicate that reporting resource consumption and footprint increases awareness of energy usage among stakeholders (customers, employees and managers). Amadeus' reporting systems include power-monitoring systems that indicate the level of energy consumption in buildings, apps that monitor gasoline usage and provide suggestions to reduce employees' carbon footprint, and footprint calculators that estimate a particular employee's carbon footprint and compare it with that of other employees. We found in our data that increasing environmental awareness through these reporting systems has had a positive impact on employees' attitudes and behaviors with regards to green practices.

More recently, in collaboration with the International Civil Aviation Organization (ICAO), Amadeus has implemented an efficient reporting system that enables travelers, firms, airlines, and travel agencies to calculate the CO₂ emissions of their journey. The company uses the International ICAO carbon calculator, which calculates emissions for each individual trip (Amadeus Global Report, 2014b). Other ICT solutions highlight Amadeus' commitment to reduce fuel consumption and emissions in the context of increasing costs of using fossil fuels. For example, the company provides a fully automated ICT solution for managing the weight and balance of all flights. The Amadeus Altéa Departure-Control Flight Management (Altéa DC-FM) module automates aircraft load control and optimizes flight departures. The module calculates passenger and cargo loads more precisely compared to other solutions and automatically defines the optimal aircraft load distribution. In other words, by automatically defining optimal load distribution, the module optimizes fuel requirements and increases uplift capacity for aircraft (Amadeus Global Report, 2014b). Finnair, which was the first airline to adopt the Altéa DC-FM solution, experienced remarkable results: a 33.7 percent reduction in unnecessary fuel burn, which contributed significantly to the airline's target of reducing overall CO₂ emissions per passenger seat by 41 percent during the 1999 to 2017 period (Amadeus Global Report, 2014b). Assuming similar level of savings achieved for other customers, the Amadeus Global Report (2014b) suggests that the amount of annual fuel and CO₂ emissions saved by the Altéa DC-FM module would exceed the total emissions associated with all Amadeus operations. Other stakeholders in the travel and tourism industry such as centralized load control offices of airport ground handlers have also benefitted from the Altéa DC-FM module (Amadeus IT Group, 2014b, 2015).

Collaborating with Munich airport, Amadeus implemented its Airport Sequence Manager (ASM) solution in 2014. ASM supports airports' collaborative decision making and improves resource usage, schedule maintenance, environmental performance, and strategic flexibility by sharing information and resources between air traffic controllers, airlines, ground handlers, and other service providers (Amadeus Global Report, 2014b). This ASM solution uses a collaborative approach to optimize the flight departure process. The solution adopts sequencing algorithms that calculate the target start-up approval time for departing flights. The ASM solution has made it possible for departing flights to leave their stand at the very last possible moment and, consequently, reduce fuel consumption and costs (Amadeus Global Report, 2015b). It is estimated that, for major European airports, an ASM-led reduction of one minute of taxi time per flight results in potential cost savings of over €120 million per annum and CO₂ reductions of around 250,000 tons per year (Amadeus IT Group, 2015). Results of experiments conducted by airports suggest that the ASM solution has helped optimize runway capacities during congestion and ensured that de-icing processes have been fully considered when planning for departures in winters (Amadeus IT Group,

2014b, 2015). The results also indicate that the ASM solution has led to improvements in terms of noise air quality and created a better shared situational awareness among all airport stakeholders (Amadeus IT Group, 2014b).

Fourth, to improve its sustainable operations, Amadeus has implemented a tool called the environmental management system (EMS) that identifies, monitors, and measures organization-wide best practices. The EMS has access to about 90 percent of the company's worldwide resource consumption data and covers 80 percent of the company's workforce. It closely monitors resource consumption data (Amadeus Global Report, 2014b). The EMS includes current data on gas consumption linked to the heating of buildings, diesel used to ensure uninterrupted power supply in data centers, and overall electricity consumption. The company closely monitors and is trying to reduce the electricity consumed by large data centers and office buildings at various sites around the world (Amadeus Global Report, 2014b). Table 5 presents the electricity consumption of 10 different Amadeus sites over the 2009 to 2011 period. In recent years, the company has implemented several projects to reduce the environmental impacts of its data center.

Table 5. Electricity Consumption at Top 10 Amadeus Site (Amadeus Global Report, 2014b)

Electricity consumption	2009	2010	2011
Number of employees: top ten sites	6,452	7,265	7,728
Electricity consumption officers: top ten sites (GJ)	111,166	113,275	110,276
Electricity consumption per employee and year (GJ)	16	16	14
Electricity consumption data center (GJ)	125,438	131,057	135,044
Number of transactions processed by data center (millions)	676.7	849.9	947.6
Energy required per one million transactions (GJ)	185	154	143
Total electricity consumption: top ten sites (GJ)	236,604	244,332	245,320

For instance, in 2012, a new energy annex building started operations. This building provided almost double the existing power capacity and cooling for data center fire cells. Since then, Amadeus has carefully monitored and reported the water used to cool servers. Thus, it has increased free cooling capacity and reduced costs by ensuring that the company optimally uses cold water (Amadeus IT Group, 2014b). Further, the company has replaced older data center cooling machines with newer, environmentally friendlier equipment. LED lamps have also replaced fluorescent lamps in the data centers, which has resulted in energy savings of more than 270,000 kWh per year (approximately equivalent to the monthly electricity consumption of 300 American homes) (Koll, 2013). In 2010, every 1,000 transactions consumed a total of 42.8kWh. By 2014, this figure dropped to 33.5kWh, a reduction of 22 percent (Amadeus IT Group, 2014b).

Amadeus manages water usage carefully by dividing it into three categories: water used in office buildings, water used for irrigation (gardens), and water used for cooling servers at the company's data centers (Amadeus Global Report, 2014b). In order to measure CO₂ emissions, the company follows the Greenhouse Gas Protocol (GHG Protocol) standards, which comprises three levels of scope: scope 1 focuses on emissions from natural gas and diesel, scope 2 focuses on emissions related to the electricity use in office buildings and data centers, and scope 3 focuses on emissions from paper consumption and business travel. Amadeus has also implemented a strategy called "activity based working", which provides staff members with a set of options to perform their work in the most suitable spaces (Amadeus Global Report, 2014b). Activity-based working has reduced the workplace environmental footprint per person and helped Amadeus improve its agility and growth with a reduced footprint (Amadeus Global Report, 2014b).

5.2.3 End-of-life Management

Given the rapid growth and speed of change in the IT industry, the lifespan of electronic devices used at Amadeus has become shorter. Although all products become obsolete at the end of their lifecycle, one can still recover and reuse their raw materials. This short lifecycle implies both a high rate of electronic disposal and an increasing need for efficient recycling processes. E-waste propagates toxic substances such as lead, mercury, cadmium, and polychlorinated biphenyls. According to the United Nation's Environment Program (UNEP, 2009) e-waste across the 27 members of the European Union is about 8.3 to 9.1 million tons per year and around 40 million tons per year for the entire world (UNEP, 2011).

To start with, Amadeus did not have any documentation to report on waste and found it hard to monitor and measure waste. However, to comply with international regulations already in place to increase recycling activities, Amadeus created an e-waste disposal policy and has been awarded the ISO 14001 standard for policy implementation. The recycling companies invoice the amount of recycling weight collected at Amadeus locations. Amadeus also measures waste generated by activities such as constructing buildings and categorizes them separately from regular waste in their reporting schedule. Overall, supported by an advanced environmental policy, the firm has accelerated its adopting a sustainable end-of-life management process. For instance, Sophia-Antipolis (SAS), an Amadeus headquarters based in France, has significantly improved its waste management after implementing these policies and practices (Table 6).

Table 6. Amadeus SAS Progress in Waste Management

Waste types and amounts: Amadeus SAS (Sophia Antipolis, France)	2008	2009	2010
Paper (t)	34.5	40	46.5
Carton (t)	31.2	31.2	32
Packaging (kg)	390	200	1,900
Glass (kg)	560	300	750
Rubble (t)	7.24	13.8	46.4
Batteries (kg)	N/A	N/A	345

5.3 SICT-CMF (Category 3) at Amadeus: People and Culture

Amadeus' efforts to build a sustainable ICT culture covered areas such as energy consumption, CO2 emissions, paper consumption, water use, and waste management (as explained in detail earlier). Clearly, the company has enacted several sustainability-focused initiatives and invested significantly in eco-friendly projects. From a people and culture perspective, staff members' attitudes towards, awareness of, and engagement with sustainable ICT initiatives are vital for Amadeus' sustainable ICT strategy implementation. Staff members' attitudes towards sustainability may be shaped by personal concerns regarding the health of the planet and a keen awareness of environmental issues. A MORI survey of 2,026 British adults found that nine out of 10 employees believe their employer's social and environmental responsibility is important to them (Dawkins, 2004).

As a particular class of corporate social responsibility (CSR) projects, sustainable ICT strategies require staff members to stay committed to the organization's environmental concerns. According to a survey that the World Economic Forum CEO conducted in 2002, staff motivation is the second most important factor making the business case for CSR projects (World Economic Forum, 2002). Collier and Esteban (2007) identify three factors that may impact staff commitment to CSR projects: 1) the extent to which staff members' identities aligns with that of the company, 2) staff members' commitment to the company, and 3) management's tone on CSR initiatives. More recently, Ditlev-Simonsen (2015) investigated if CSR activities had an impact on staff members' commitment and to what extent staff CSR perception and involvement in decision processes were related to their commitment. They found that CSR perception was a significant predictor of staff members' commitment.

In our interviews at Amadeus, we found that most of the staff members believed that economic drivers primarily drive the company (e.g., reducing the energy bills and improving brand image) and that "ecological drivers" do so secondarily. Some respondents also pointed to "legal drivers". Some extant research echoes these findings. For instance, Renwick, Redman, and Maguire (2013) argue that some major multinational companies have adopted green HR management practices in order to position themselves as attractive employers for an increasingly environmentally aware younger generation. Interestingly, very few of our respondents believed that Amadeus' sustainable ICT strategy could make the company more competitive (see Figure 5).

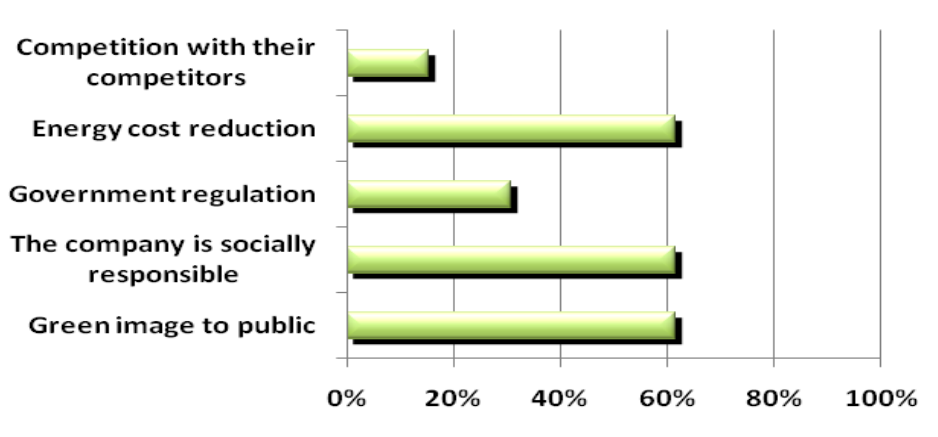


Figure 5. Staff Members' Perceptions of the Drivers for Developing Sustainable ICT Capability (Sample Size: 28)

This result indicates a possible lack of communication between senior managers and staff members with regards to the increasing importance of sustainable ICT capability. It also suggests that Amadeus senior managers can improve staff members' engagement in sustainable ICT initiatives by effectively explaining the positive business impacts of the organization's environmental focus to all staff members. About half of our respondents believed the company was actively involved with sustainability initiatives. However, about 45 percent of the participants seemed to think that senior managers "only slightly" felt responsible towards the environment (see Figure 6). Furthermore, only one out of all of the participants was aware of the firm's long-term goals with regards to sustainability. It seems senior managers' interest in sustainable ICT capability could be better communicated internally in order to foster a sustainable culture with creative involvement and inputs from all staff members.



Figure 6. Staff Perception of the Importance of Sustainability to Senior Managers

5.3.1 Staff Members' Willingness to Play an Active Role in Developing Sustainable ICT Capability

Kuo and Dick (2009) suggest that employees' sense of social responsibility in adaptable organizations motivate sustainable ICT efforts rather than issues of economics and technologies. Staff members' willingness to participate and play an active role in sustainable ICT initiatives determines the successful development of sustainable ICT capability. Our primary data indicate that staff members' were highly aware of the importance of being green and that they had a strong belief that the company should develop sustainable operations and offer green services to customers (see Figure 7).

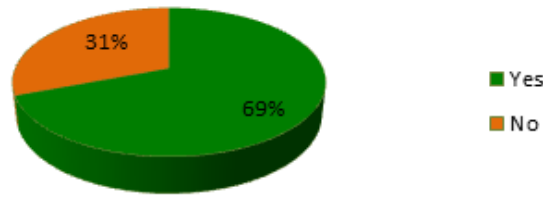


Figure 7. Staff Members’ Response to the Question: “Do You Feel it is Important that the Company Should Develop Green Operations and Offer Green Services to Customers?”

Most respondents expressed willingness to dedicate more time to successfully develop the organization’s sustainable ICT capability. At the same time, they felt that few employees actually participated in such efforts because they were unsure of sustainable ICT capability’s potential to contribute to business value. Table 7 presents some interview quotes in response to the questions: “Do you feel it is important the company should develop green operations and offer green services to customers?”, “Would you be willing to spend more time to development of sustainable ICT capability?”, and “In your view, is it only the responsibility of the sustainability team to think and act green?”.

Table 3. Quotes from Staff Members’ Responses (Sample Size: 28)

<p>Positive quotes</p>	<p>R1: “Yes, I want the company that I am working in to be sustainable. I think that everyone should be helping towards that goal.... I know we had some green initiatives, which were in the pipeline a few years ago, for example on selling platform they would not only show the speed of the flight but also how much carbon footprint this flight would have. But all these initiatives were always put to the side because we were not making any money from it. I really hope that the company could be more green and responsible!”</p> <p>R2: “I think it is everyone’s job to be green but we need to have some guidelines put in place or people will just complain they do not have enough time and that it is useless as it won’t help the company make more profit”</p> <p>R3: “I think doing business with an eco-friendly company boosts customer and shareholder satisfaction so to offer green options to our clients can only be beneficial for the planet, for the company image and for the clients too.”</p>
<p>Negative quotes</p>	<p>R4: “I am already overloaded, I have 100 emails coming every day, so really I just have no time to think or act green. I do know that my words might sound controversial but in this highly competitive world, green is not welcome. I am more than happy if the company has a sustainability team working on being green, but I do not want them to bombard me with emails.”</p> <p>R5: “Personally, I strongly disagree with any regulation coming from the government, Brussels or elsewhere, because at the end of the day, regulations turn to be always incorrect.”</p> <p>R6: “It is not the responsibility of the sustainability team to think and act green. If the government values the environment, they have the potential to set more strict policies. Otherwise there is no motivation to act green.”</p> <p>R7: “I obviously know that it is good to be green and to help the environment, but I guess that my laziness is taking over my environmental guilt. Say I have forgotten to switch my computer and I am already on my way out, I know myself, I will not go back, I will just go home and hopefully think of switching it the next day.”</p>

5.4 SICT-CMF (Category 4) at Amadeus: Governance

Amadeus senior managers feel that the travel and tourism industry is under great pressure to better keep track of, measure, manage, and reduce its environmental impact. Customers are also on the lookout for tools and advice to better understand the negative consequences of travelling and to reduce environmental harm (Amadeus Global Report, 2014b). Our data suggests that Amadeus has established consistent policies and robust mechanisms of governance to meet sustainability objectives. The company’s organizational hierarchy has well-defined structures and organizational roles for coordinating sustainable ICT initiatives. Amadeus’ senior management play a leading role in sustainable ICT initiatives and are formally involved in setting targets for reducing the company’s carbon footprint. The organization has established clear metrics for assessing the impact of all sustainable ICT initiatives. The company’s risk and compliance office proactively evaluates the environmental impact of operations in line with the highest sustainability standards (Amadeus IT Group, 2015).

Amadeus works with several regulatory bodies around the world, including national governments, the European Commission, the European Parliament, the U.S. Department of Transportation, and the main industry trade associations and consumer organizations to develop industry-wide governance best practices in order to build a more sustainable travel and tourism industry (Amadeus IT Group, 2015). The efforts to create robust industry-wide standards have resulted in some significant positive outcomes. For instance, due to factors such as data's unreliability, uncertainty surrounding the effects of global warming, and the appropriateness of linking aircraft emissions to individual passengers, calculating CO2 emissions was a challenging task because different calculators produced significantly different emission outcomes for the same itinerary (Amadeus Global Report, 2014b). To address this challenge, Amadeus and the International Civil Aviation Organization (ICAO) entered into an agreement in 2009 to promote the ICAO CO2 calculator. Given ICAO's position as the leading global civil aviation organization with a membership of over 190 countries, the ICAO CO2 calculator is now considered an international industry standard (Amadeus Global Report, 2014b). More recently, Amadeus joined 20 travel industry bodies to launch a European Tourism Manifesto, which the European Commission and the European Parliament supported. This manifesto highlights E.U. policy priorities for the sector, and Amadeus provides key inputs into areas such as digitization, transport connectivity, and sustainability (Amadeus IT Group, 2015). The company has also been a strategic partner of the International Air Transport Association (IATA) for more than 25 years and collaborates closely in developing new industry standards. Meanwhile, in 2015, the company launched a new partnership agreement with the United Nations World Tourism Organization (UNWTO) and the European Travel Commission (ETC) to collaborate on different projects to set sustainability governance standards for the travel and tourism industry (Amadeus IT Group, 2015) (see Figure 8).

Finally, Amadeus appears well prepared to comply with/strategize in response to emerging ICT and business sustainability legislation and regulation. One good example of such an emerging regulation is the E.U. Emissions Trading Scheme. Although this type of E.U. regulation could potentially create additional costs in short term, such schemes are unlikely to reduce the growing demand for travel. One can consider Amadeus' growing geographical diversification as a governance strategy that shields the company from the negative impact of such regulations in near future (Amadeus IT Group, 2014b).

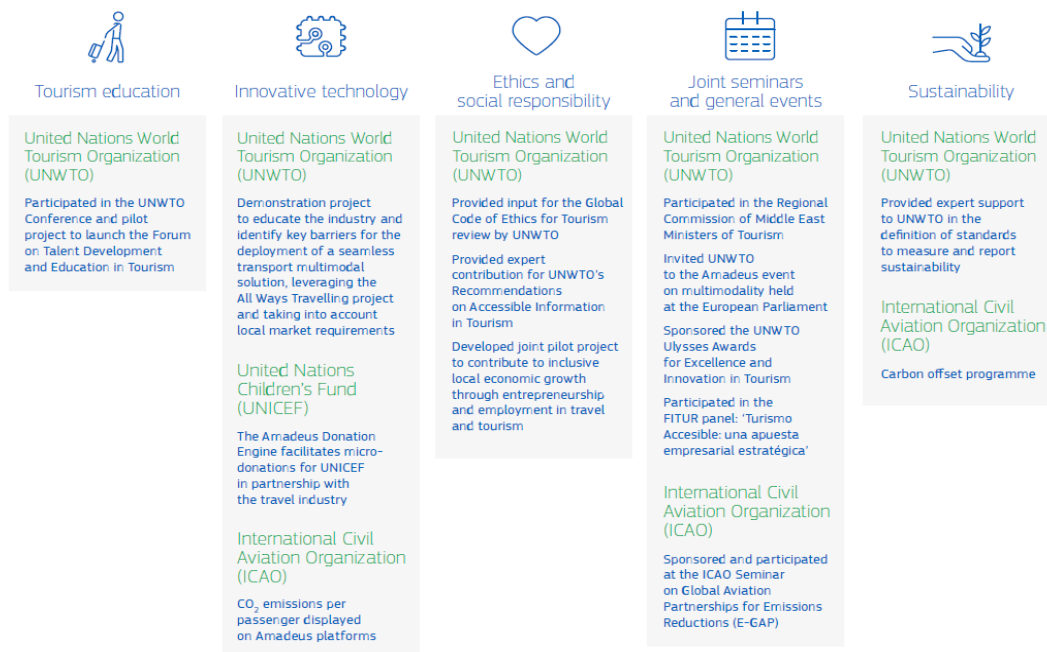


Figure 8. Amadeus' Collaboration with U.N. Agencies (Amadeus IT Group, 2015)

6 Lessons Learned

The above findings describe and explain Amadeus' sustainable ICT program with reference to the SICT-CMF framework. They address the first research question (see Section 1) by documenting several key achievements of Amadeus' sustainable ICT strategy implementation. The rigor and strength of the

processes that underlie Amadeus' sustainability initiatives suggest that the company is at "level 4" or "advanced" level (see Table 2). The second research question focuses on lessons learned from Amadeus' experience of implementing sustainability initiatives. Broadly, we can draw three key lessons from our findings.

6.1 Lesson 1: Sustainability can be a Core Component of ICT and Business Planning Lifecycles

Amadeus' experience over the last few years will help the company produce a more comprehensive road map for how it can carefully integrate and align sustainability with strategy. In other words, the company now has an opportunity to develop a clear long-term plan for how sustainability can be a core component of its ICT and business planning lifecycles. Despite growing in terms of employees, transactions, and revenue over the years, the company's focus on sustainability projects has ensured that resource consumption associated with operations has grown at a significantly slower pace (Amadeus, n.d.). The company has managed to significantly reduce CO2 emissions per employee. In 2010, CO2 emissions (scopes 1 and 2) per employee amounted to 3,724kg, while, in 2014, this figure fell to 3,331 kg—an overall reduction of 11 percent. Similarly, the company's implementation of solutions such as the Amadeus Environmental Management System (EMS) has led to several positive outcomes that other companies can aspire to as well. The findings further illustrate how ICT and business can jointly drive sustainability programs and progress given that travelers and the general public are increasingly aware of climate change risks and expect environmentally responsible operations from companies. From a broader perspective, these findings suggest that organizations need to recognize sustainable ICT as a significant contributor to their sustainability strategies. Sustainable ICT programs align business and sustainable ICT metrics and help achieve greater success across the enterprise. It also helps design policies that enable companies to achieve best practices.

6.2 Lesson 2: Sustainable ICT Initiatives Offer Opportunities to Enhance Competitive Branding

The findings suggest that Amadeus is an environmentally conscious company. Such a view has helped the company improve its image in the travel and tourism industry. Indeed, recent studies suggest that organizations that adopt sustainability initiatives are rewarded with increased profit and market share. Mithas, Khuntia, and Roy (2010) suggest that sustainable ICT has the potential to impact firm profitability by impacting revenue growth, reducing costs, reducing risks, and winning the environmentally conscious segment of the market. Firms with higher sustainable ICT spending can differentiate their products from competitors' products based on their environmentally friendly branding (Dangelico & Pujari, 2010; Shrivastava, 1995). Lyon and Shimshack (2015) recently analyzed the impact of an environmental rankings scheme for a sample of large companies in the US. They found strong evidence that Newsweek's 2009 Green Rankings had a significant impact on rated firms' capital market performance: firms in the top 100 obtained returns that were 0.6 to 1.0 percent greater than those of the bottom 400.

Amadeus is also now part of key external sustainability indices such as the Dow Jones Sustainability Index (DJSI) and the Carbon Disclosure Project (CDP). The DJSI evaluates sustainability performance along economic, social, and environmental dimensions, and only companies that feature in the top 10 percent of scorers for each activity sector can enter the index (Amadeus IT Group, 2014b). In 2014, Amadeus joined the Carbon Performance Leadership Index of the Carbon Disclosure Project (CDP). The CDP evaluates the disclosure and transparency of information on a 0 to 100 score range and the performance on a score range from E to A. Amadeus' scored 93 in the former category and an A in the latter category (Amadeus Global Report, 2014b). In 2015 Amadeus' score in the CDP was 98 (Amadeus IT Group, 2015). Inclusions in these indices reaffirm Amadeus' commitment to sustainability initiatives and also helps showcase the company's environmental focus to the wider market. They also provide an aspirational roadmap for other companies, particularly in the travel and tourism industry. Overall, Amadeus' experience suggests that a carefully developed sustainable ICT program can enhance an organization's competitive branding in the global market place.

6.3 Lesson 3: Senior Managers Need to Facilitate Employee Commitment to Sustainability Projects

Our findings also suggest that, in order to realize various benefits that sustainable ICT capability can offer, a company needs to facilitate staff members' awareness and engagement by effectively communicating the business value of sustainability to employees. Companies should ensure that their sustainable ICT strategy aligns with other organization-wide sustainability objectives and motivate employees to participate in the strategy's development and implementation. Previous research suggests that it is important to involve staff members in development of CSR initiatives very early on. Senior managers usually make CSR decisions (Brammer & Millington, 2003; Burton & Goldsby, 2009; Treviño, Weaver, & Brown, 2008). Staff members may not always be aware of or agree with decisions made by management as part of an organizational sustainable ICT strategy. It is important to note that successfully delivering sustainability commitments depends on buy-in not just from senior management but also from staff members across the firm (Lyon, 2004). By involving employees early on in decisions, managers can promote positive identification with corporate values and encourage staff members' commitment to sustainability strategies (Maclagan, 1999).

7 Limitations

As with any other study, this study has limitations. We conducted the interviews with staff members to gauge their level of awareness and engagement in 2012; since then, Amadeus IT Group has significantly increased its investments in sustainable ICT capability in order to support an advanced environmental policy. As such, the company could have made further progress in the people and culture category of the SICT-CMF, which this study does not capture. We need further research to extend this study with more recent data and compare the findings. Future studies could also conduct a similar analysis for other companies in the travel and tourism industry and others.

8 Conclusion

Watson et al. (2012) argue that the makings of a new sustainability dominant logic are presently taking shape as society moves beyond customer service towards an environmental focus. Although initially viewed as a means of reducing the risk of lawsuits and clean-up costs from environmental damage, a growing number of business leaders are recognizing the potential benefits of adopting sustainability strategies ahead of the pack. In this exploratory study, we applied the sustainable ICT capability maturity framework to the case of Amadeus, a large corporate enterprise involved in the travel experience of close to two million passengers every day and specializing in IT solutions. We mainly investigated the current capability maturity level of sustainable ICT in the company. The company demonstrated an "advanced" level of sustainability capability. Currently, Amadeus seems to be a market leader in terms of sustainability capabilities. The experience of Amadeus suggests that other companies will reap several strategic benefits from demonstrating a clear commitment to sustainable ICT initiatives.

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Appendix A: Interview Questions

Participant's knowledge of sustainable ICT:

- Do you know what sustainable ICT refers to?
 - If not, we provided a definition of sustainable ICT with specific examples to the participants.

Sustainable ICT in Amadeus IT Group:

- Are you aware of sustainable ICT initiatives in Amadeus IT Group?
 - Cooling data centers
 - Use of virtual software
 - Recycling of disposal obsolete IT equipment
 - Developing green operations and offering green services to customers
 - Reducing printing
 - Replace energy sourcing to more eco-friendly ones
 - Alternative communication devices to reduce carbon footprint
 - Energy saving for ICT equipment
 - Just one laptop per employee
 - Use thin clients
 - Cloud computing
- How has Amadeus IT Group promoted sustainable ICT capability?
- How important is development of sustainable ICT capability to senior managers within Amadeus IT Group?
- How important involvement in sustainability initiatives is to Amadeus IT Group in your opinion?
- How do you feel Amadeus IT Group is engaged with sustainability initiatives compared to other companies in the travel and tourism industry?
- Can you identify gaps that need to be modified?

Sustainable ICT motivational drivers in Amadeus IT Group:

- Why do you think Amadeus IT Group is involved in the development of sustainable ICT capability?
 - To promote a positive image to the public
 - The company is socially responsible
 - Because of government regulations
 - To reduce energy cost and save money
 - To compete with their competitors
- Amadeus IT Group's environmental strategy
 - is an image-orientated strategy where most financial resources are invested toward promoting Amadeus IT Group's green initiatives
 - is a prevent and control strategy that reduces the negative impact on the environment. This kind of strategy mainly focuses on reducing cost and implementing short-term solutions.
 - implies that the organization is actively involved in protecting the environment. Green goals are set to constantly improve.
- Does Amadeus IT Group have stated long-term sustainability goals?
- Does Amadeus IT Group have a sustainable ICT mission and vision statement?
- How do senior managers in Amadeus IT Group communicate their sustainable ICT strategy to employees?

Participants' views on Sustainable ICT:

- Do you think that organizations should be concerned about environment?
- Would you be willing to spend more time on sustainable ICT capability development?
- Is it only the responsibility of the sustainability team to think and act green?
- Do you feel it is important that the company should develop green operations and offer green services to customers?

- How do you feel about Amadeus IT Group's sustainable ICT strategy?
- What does it mean to you to be part of a company involved with sustainable ICT capability?

About the Authors

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