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 his or her title. The travel and tourism industry produced 14% of global greenhouse gas emissions in 2010. Policy makers have responded with ambitious targets. The European Union aims to achieve a 60% 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 specializing in IT solutions. The study investigates the current capability maturity level of sustainable ICT within the company. The findings suggest that the company is a market leader in terms of sustainability initiatives, demonstrating an “Advanced” level of sustainability capability. The lessons learned from Amadeus’ experience are discussed.

Keywords: Sustainable ICT-Capability Maturity Framework, Strategy, Travel and Tourism Industry
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 et al, 2012, Gholami et al, 2016, Gholami et al, 2017, Anon Higon et al, 2017). In order to differentiate themselves in a globally competitive market, companies are looking to develop their green reputation\(^2\). Hall et al (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 his or her 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% of global greenhouse gas emissions in 2010\(^3\). Policy makers have responded with ambitious targets. For example, the European Union (EU) aims to achieve a 60% 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 IT Group Future Traveler Tribes, 2030)\(^4\). This market segment tends to be extremely conscious of their impact on society and the environment and is keen on travelling in moderation, supporting environment-friendly businesses and availing services such as carbon offsetting.

\(^2\) [http://www.youtube.com/watch?v=c6SkEkaoMlk](http://www.youtube.com/watch?v=c6SkEkaoMlk)
\(^3\) [http://www3.epa.gov/climatechange/ghgemissions/global.html](http://www3.epa.gov/climatechange/ghgemissions/global.html)
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% (Climate Group, 2008). Information systems (IS) have been a major contributor to economic growth and productivity over the last two decades (Devaraj and Kohli, 2000, Stiroh, 2002, Dedrick et al., 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 modifying flight plans on the fly to use the least amount of fuel. They can improve airports’ communication with planes and increase efficiency of waiting ground crews (Initiative for Global Environmental Leadership, 2014). ICT devices such as smartphones provide customers the opportunity to check real time bus locations 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 internet of things could also eliminate inefficiencies in freight rail operations, saving $27 billion over 15 years, and capital expenditure on oil and gas exploration could be reduced by $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 awareness about key social and environmental issues (Campbell, 2007).
This paper explores the sustainable ICT strategy of Amadeus IT Group (simply referred to as Amadeus in the rest of the paper). Amadeus is a major global player in the travel and tourism industry. It is a large corporate enterprise specializing in IT solutions and involved in the travel experience of close to two million passengers every day. The paper addresses two questions: *What are the achievements of Amadeus’ sustainable ICT strategy implementation? 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 the achievement of 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. The rest of the paper is organized as follows. The next section reviews sustainable ICT maturity models with a particular focus on the Sustainable ICT-Capability Maturity Framework (SICT-CMF). This is followed by a note on the research methods and a description and analysis of Amadeus’ sustainable ICT strategy in light of the SICT-CMF model. The final part of the paper elaborates on the lessons learned from Amadeus’ experience.

**A Framework for Sustainable ICT Strategy and Implementation**

Typically, successful sustainability strategies involves the adoption of an integrated framework along the value chain covering three main areas: a) Preparation and planning for sustainability as a core component of the business strategy; b) Implementing sustainability initiatives by moving towards sustainable energy, sustainable products or services and sustainable processes; and c) 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 was developed by Molla and Cooper (2009) and Molla et al (2011); “Green IT Capability Maturity Model” (Philipson, 2010) that was used for the global survey conducted by Fujitsu (Fujitsu, 2010, Rowe 2011); “Green IT Maturity Assessment Program” (Accenture, 2010); “Green ICT Scorecard” that was designed by CIO/CTO Council of the UK (McGregor, 2008); and the “UK Government Green ICT Maturity Model” (HMG CIO Council Green ICT Delivery Unit, 2012). In 2008, Ireland’s Innovation Value Institute in collaboration with an industry consortium (including Intel, Microsoft, SAP, Chevron, Cisco and Fujitsu) developed the “Sustainable ICT-Capability Maturity Framework” (SICT-CMF) for systematically assessing and improving sustainable ICT capabilities (Donnellan et al, 2011, Curry et al, 2012). The SICT-CMF is the most well-known and widely used framework for analyzing the Sustainable ICT Capability of firms. The SICT–CMF enables firms to measure their current maturity level and implement a set of practices to increase their SICT capability level (Curry and Donnellan, 2012). In other words, the framework helps firms identify and assess capability gaps, and provides opportunities to improve their SICT performance (Curry and Donnellan, 2012).

The SICT–Capability Maturity Framework comprises four categories: 1) “Strategy and planning” includes the specific objectives of sustainable ICT and its alignment with the organization’s overall sustainability strategy; 2) “Process management” includes the sourcing, operation and disposal of ICT, as well as the provision of systems based on sustainability objectives and the reporting of performance; 3) “People and culture” defines a common language to improve communication throughout the enterprise and establishes activities to help embed sustainability principles across the enterprise; and 4) “Governance” develops common and consistent policies and requires accountability and compliance with relevant regulation and legislation (Curry and Donnellan, 2012) (see Table 1).
Table 1. Four Categories of Sustainable ICT  
(Curry and Donnellan, 2012)

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategy &amp; Planning</td>
<td>This category includes the specific objectives of sustainable ICT and its alignment with the organization’s overall sustainability strategy.</td>
</tr>
<tr>
<td>Process Management</td>
<td>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.</td>
</tr>
<tr>
<td>People and Culture</td>
<td>This category defines a common language to improve communication throughout the enterprise and establishes activities to help embed sustainability principles across the enterprise.</td>
</tr>
<tr>
<td>Governance</td>
<td>This category develops common and consistent policies and requires accountability and compliance with relevant regulation and legislation.</td>
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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 involved with corporate social responsibility (CSR) initiatives in order to understand their assessment of the maturity level and importance of sustainable ICT capabilities within the firm. The assessment can provide valuable insights into a company’s sustainable ICT capabilities and how key stakeholders and staff view both the importance and maturity of capabilities. In the next sections of the paper, 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>
<thead>
<tr>
<th>Maturity Level</th>
<th>Strategy and Planning</th>
<th>Process Management</th>
<th>People and Culture</th>
<th>Governance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>5. Optimizing</strong></td>
<td>- Stakeholders across extended enterprise acknowledge sustainability as a success factor in driving business strategy - CEO leverages sustainability as business differentiator</td>
<td>- 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</td>
<td>- Common language adopted across extended enterprise - Sustainability is a core value and organization is recognized for thought leadership - CEO accountable for branding and image</td>
<td>- Driving international standards and legislation - Pervasive influence - Innovation of policies and adoption across extended enterprise</td>
</tr>
<tr>
<td><strong>4. Advanced</strong></td>
<td>- Sustainability is a core part of ICT and business planning cycle - Senior management led enterprise-wide sustainability metrics</td>
<td>- ICT and business role incentives aligned to impact and success for sustainability across the enterprise - Staff mentoring/skills focus - Best practice recognized</td>
<td>- ICT and business role incentives aligned to impact and success for sustainability across the enterprise - Staff mentoring/skills focus - Best practice recognized</td>
<td>- Enterprise compliance with policies is a core business accountability - Regulations and policies updated with best practice developed to exceed targets</td>
</tr>
<tr>
<td><strong>3. Intermediate</strong></td>
<td>- ICT sustainability strategy and execution plans in place and integrated across prioritized ICT programs - Some business metrics defined and used where local opportunities arise</td>
<td>- 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</td>
<td>- Capability/skills development key asset for staff development - Staff encouraged to contribute to sustainability programs and visibility - ICT has adopted common language with limited business adoption</td>
<td>- Common policies and accountabilities documented and applied to all ICT initiatives - Business accountability with limited adoption of best practices</td>
</tr>
<tr>
<td><strong>2. Basic</strong></td>
<td>- Limited sustainability, strategy planning and execution where visible, approach and metrics are inconsistent</td>
<td>- Basic reactive sourcing; disposal based on local policy - Sustainability not integrated into ICT thinking - Reactive approach to SICT performance and reporting</td>
<td>- Common language defined and limited use within ICT - Increasing awareness within ICT of sustainability issues, but little coherence</td>
<td>- Common policies may exist with limited documentation and inconsistent adoption within the ICT organization - Awareness of compliance but limited accountability to meet requirements</td>
</tr>
<tr>
<td><strong>1. Initial</strong></td>
<td>- No ICT sustainability strategy, execution planning in place - Any sustainability metrics are ad hoc and inconsistent</td>
<td>- Any attempt at the management of a sustainable life cycle is ad hoc - ICT systems are not designed to meet sustainability metrics There is little sustainability tracking or reporting</td>
<td>- No awareness of ICT-related sustainability issues or language - No communications across the ICT organization and the business on sustainability issues</td>
<td>- Type and level of compliance unknown - Any accountability or policies that exist are ad hoc</td>
</tr>
</tbody>
</table>

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

In this research, drawing on the SICT-CMF for analyzing firms’ sustainable ICT capability, and adopting the qualitative case study approach (Mayasandra et al., 2006, Sandeep and Ravishankar, 2014), we set out to 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 Amadeus’ Global Report 2014 and 2015, 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 (in Amadeus’ Sophia-Antipolis office, which is one of the company’s headquarters based in France) from the 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 within the firm (see Appendix).

The interviews were conducted in 2012 and lasted on average between 30-60 minutes. All the interviews were recorded and transcribed. The interviews started with a quick introduction allowing 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 perception of the firm’s drivers for development of Sustainable ICT capability. Third, we consulted a number of 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.

Case Description - Amadeus IT Group

Amadeus IT Group is a large corporate enterprise in the travel and tourism industry, which provides specialized IT solutions. It is a multinational firm offering “neutral” flight availability data, allowing 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 Saber 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 thousand employees across 195 countries (Amadeus Global Report, 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 provides an overview of Amadeus’ 2014 revenues, operating income and margins relative to its two main competitors.\(^5\)

Amadeus has gradually diversified its solutions and services and now provides IT solutions to other business in 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, 2014). For example, the company’s IT2Rail and the Innovation Program 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 2014). 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).

\(^{5}\) http://www.tnooz.com/article/GDS-Travelport-Sabre-Amadeus-2014-earnings/
Table 3. Revenues, Operating Income (EBITDAs) and Margins in 2014

<table>
<thead>
<tr>
<th></th>
<th>Sabre</th>
<th>Travelport</th>
<th>Amadeus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>$2.631m (total revs)</td>
<td>$2.148m (net revs)</td>
<td>$3.834m</td>
</tr>
<tr>
<td>EBITDA</td>
<td>$840m (total, adjusted)</td>
<td>$540m (adjusted)</td>
<td>$1.464m</td>
</tr>
<tr>
<td>Margin</td>
<td>31.9%</td>
<td>25.1%</td>
<td>38.2%</td>
</tr>
</tbody>
</table>

Findings

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

We found that Amadeus’ sustainable ICT strategy and planning revolves around three pillars: a) Improving green operations and optimizing the environmental performance of operations; b) Offering environment friendly IT solutions for customers in order to help them achieve their environmental objectives and targets; and c) Industry initiatives, which involves 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, savings of more than €1M per year are estimated against annual electricity costs of over €4M (Amadeus Global Report, 2014). 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 Global Report, 2014, 2015).

For instance, Amadeus’ Altéa Departure Control System reduces the amount of fuel, emissions and costs for airlines through improved aircraft weight estimations (Amadeus Global Report, 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, 2014). Overall, it is evident that Amadeus’ sustainable ICT strategy has been well-planned, delivering significant results since its implementation in 2009.
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: (a) the sourcing of sustainable ICT; (b) development of sustainable operations; and (c) end of life management.
The Sourcing of Sustainable ICT

This process involves the implementation of sustainable sourcing practices by deeply embedding environmental concerns into the company’s ICT procurement choices. The process of sourcing sustainable ICT involves a careful assessment of energy usage and footprint of ICT hardware (e.g., data centers), energy rating of ICT equipment, analyses of suppliers’ green image and initiatives (Rao and Holt, 2005), green design of products (e.g., wrapping, product lifespan and possibility of recycling the equipment) and social-ethical assessment of procurement (Molla et al, 2008). Amadeus is facing increasing demand for green products from buyers and hence has implemented a number of 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 process.

Amadeus employees not only have to select suppliers who produce their goods and services in a sustainable manner, but are also required 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 life span 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 focusing 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 in complying with global green initiative standards to assess energy needs.
Amadeus’ development of sustainable operations includes adoption of 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 amongst 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 enabling e-ticket generation has reduced paper usage, thus saving many trees. Overall energy consumption has also gone down significantly by sharing information via virtual websites such as Blackboards or Wiki and thus diminishing the need for hardware, as 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”, are useful sustainability tips that 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 Global Report, 2015). Several airlines’ applications are now hosted on ACUS cloud-based Common Use service and high efficiencies have been recently reported (Amadeus Global Report, 2014). ACUS enables passenger processing systems to be accessed anywhere within and outside the airport.
terminal, thus facilitating agile, flexible and scalable operations, as well as reducing cost. In emergencies, ACUS ensures operational continuity at airports by increasing terminal capacity at check-in and transfers, moving facilities to another location and by putting ad-hoc or mobile workstations in place (Jarrell, 2016)⁶ (see Figure 3). It also reduces energy consumption at airport buildings with recent figures showing customer annual savings of 630 MWh in the use of equipment and peripherals (Amadeus Global Report, 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, thus allowing more people to read material without the need to print multiple paper copies. Double-sided printing and removal of cover pages by default have now been adopted as 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.

Implementation of 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). The aim is 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% (Amadeus Corporate Social Responsibility Report, 2012).

Figure 3: Traditional Common Use Terminal Systems (CUTE) Infrastructure versus Amadeus ACUS \(^7\) (Amadeus Global Report, 2015)

\(^7\) https://www.youtube.com/watch?v=JPFRvIW29R8
In 2010, the company’s top 10 sites consumed over 82,090kg of paper, with each employee consuming 11.3kg of paper. By 2014, this consumption was reduced to 52,620kg, and each employee consumed only 6.1kg of paper – a reduction of 46.1% in overall consumption of paper, per employee.\(^8\)

*Figure 4. Green Printing with FollowMe*

Third, Amadeus has implemented a number of specialized information systems to facilitate reporting and forecasting. Several recent travel and tourism industry white papers indicate that reporting 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, which enables travelers, firms, airlines and travel agencies to calculate CO\(_2\) emissions of their journey. The company

uses the International ICAO carbon calculator, which calculates emissions for each individual trip (Amadeus Global Report, 2014). 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, 2014). Finnair, which was the first airline to adopt the Altéa DC-FM solution experienced remarkable results: a 33.7% reduction in unnecessary fuel burn, thus contributing significantly to the airline’s target of reducing overall CO$_2$ emissions per passenger seat by 41% during the period 1999-2017 (Amadeus Global Report, 2014). Assuming similar level of savings achieved for other customers, the Amadeus Global Report (2014) suggests that the amount of annual fuel and CO$_2$ 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 Global Report, 2014, 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, 2014). This ASM solution uses a collaborative approach to optimize the flight departure process. The solution
is based on sequencing algorithms, which calculates 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, 2015). It is estimated 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 reduction of around 250,000 tons per year. Results suggest that the ASM solution has helped optimize runway capacities during congestion, and ensured that de-icing processes have been fully taken into account when planning for departures in winters (Amadeus Global Report, 2014, 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 Global Report, 2014).

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% of the company’s worldwide resource consumption data and covers 80% of the company workforce. It closely monitors resource consumption data (Amadeus Global Report, 2014). The EMS includes up-to-date data on gas consumption linked to 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 globe (Amadeus Global Report, 2014). Table 5 presents electricity consumption of 10 different Amadeus sites over the period 2009-2011. In recent years, the company has implemented several projects to reduce the environmental impacts of its data center.
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. Water used for cooling of servers is now carefully monitored and reported. Thus, it has increased free cooling capacity and reduced costs by optimal use of cold water (Amadeus Global Report, 2014). Further, older data center cooling machines have been replaced by newer, environment-friendlier equipment. Fluorescent lamps in the data centers have been replaced by LEDs lamps resulting in energy savings of more than 270,000 kWh per year, which is approximately equivalent to the monthly electricity consumption of 300 American homes⁹. In 2010, every 1000 transactions consumed a total of 42.8kWh. By 2014, this figure dropped to 33.5kWh, a reduction of 22% (Amadeus Global Report, 2014).

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 of servers at the company’s data centers (Amadeus Global Report, 2014). In order to measure CO₂ emissions, the company follows the Greenhouse Gas Protocol (GHG Protocol) standards, which comprises three levels of scope: Scope 1 includes emissions from natural

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gas and diesel. In Scope 2, emissions related to the electricity use in office buildings and the data center is included. Scope 3 focuses on emissions from paper consumption and business travel. Amadeus has also implemented a strategy called “activity based working”, which provides staff with a set of options to perform their work in the most suitable spaces (Amadeus Global Report, 2014). 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, 2014).

**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, the raw materials can still be recovered and reused. This 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 was about 8.3 – 9.1 million tons per year and the global estimate around 40 million tons per year (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. It takes the help of recycling companies, which invoices the amount of recycling weight collected at Amadeus locations. Amadeus also measures waste generated by activities such as building works and categorizes them separately from regular waste in their reporting schedule. Overall, supported by an advanced environmental policy, the adoption of a sustainable end of life management process has been
accelerated within the firm. For instance, Sophia-Antipolis (SAS), an Amadeus headquarters based in France has realized significant waste management improvement after implementing these policies and practices (Table 6).

**Table 6: Amadeus SAS Progress with regards to Waste Management**

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

**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). It is evident that a number of sustainability-focused initiatives are running and significant investments have been allocated towards eco-friendly projects. From a people and culture perspective, staff attitude towards, awareness of, and engagement with sustainable ICT initiatives are vital for Amadeus’ sustainable ICT strategy implementation. The attitude of staff 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 to stay committed to the organization’s environmental concerns. According to a survey conducted by the World Economic Forum CEO 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 - the extent to which staff identity is aligned with that of the company, staff commitment to the company, and the management tone on CSR initiatives. More recently, Ditlev-Simonsen (2015) investigated if CSR activities had an impact on staff 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 commitment.

In our interviews at Amadeus, we found that most of the staff believed the company is driven first by “economic drivers” (e.g. reducing the energy bills and improving brand image) and then by “ecological drivers”. Some respondents also pointed to “legal drivers”. Some extant research echoes these findings. For instance, Renwick et al (2013) argue that some major multinational companies are adopting 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).
This result indicates a possible lack of communication between senior managers and staff with regards to the increasing importance of sustainable ICT capability. It also suggests that Amadeus senior managers can improve staff engagement in sustainable ICT initiatives by effectively explaining the positive business impacts of the organization’s environmental focus to all staff. About half of our respondents believed the company is actively involved with sustainability initiatives. However, about 45% of the participants seemed to think that senior managers “only slightly” feel 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.
Staff willingness to play an active role in developing sustainable ICT capability

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

Figure 7: Staff 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 the successful development of the organization’s sustainable ICT capability. At the same time, they felt that participation was not very high because employees were unsure of the potential of sustainable ICT capability 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 7: Quotes from Staff Responses  
(Sample Size: 28)

| Positive quotes | 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, e.g. 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!”  
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”  
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.” |
| 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.”  
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.”  
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.”  
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.” |

**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, measure, manage and reduce 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, 2014). Our data suggests that Amadeus has established consistent policies and robust mechanisms of governance to meet sustainability objectives. There exist well-defined structures and organizational roles within the organizational hierarchy for coordinating sustainable ICT
Amadeus' senior management play a leading role in sustainable ICT initiatives and are formally involved in setting targets for carbon footprint reduction. Clear metrics have been established 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 Global Report, 2015).

Amadeus works with several regulatory bodies around the world, including national governments, European Commission, European Parliament and the US Department of Transportation, as well as 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 Global Report, 2015). The efforts to create robust industry-wide standards have resulted in some significant positive outcomes. For instance, due to factors such as reliability of data, uncertainty surrounding the effects of global warming and the appropriateness of linking aircraft emissions to individual passengers, calculating CO₂ emissions was a challenging task with different calculators producing significantly different emission outcomes for the same itinerary (Amadeus Global Report, 2014). 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, 2014). More recently, Amadeus joined 20 travel industry bodies to launch a European Tourism Manifesto, supported by the European Commission and the European Parliament. This manifesto highlights EU policy priorities for the sector with Amadeus providing key inputs into areas such as digitization, transport connectivity and sustainability (Amadeus Global Report, 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 the
development of 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, with the objective of setting sustainability governance standards for the travel and tourism industry (Amadeus Global Report, 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 EU Emissions Trading Scheme. Although, this type of EU regulation could potentially create additional costs in short term, such schemes are unlikely to reduce the growing demand for travel. Amadeus’ growing geographical diversification can be considered as a governance strategy that shields the company from the negative impact of such regulations in near future (Amadeus Global Report, 2014).
Lessons Learned

The above findings describe and explain Amadeus’ sustainable ICT program with reference to the SICT-CMF framework. It addresses the first research question articulated in the introduction section of the paper by documenting several key achievements of Amadeus’ sustainable ICT strategy implementation. The rigor and strength of the processes underlying 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, three key lessons can be drawn from our findings.

Lesson 1: Sustainability can be a core component of ICT and business planning life cycles

Amadeus’ experience over the last few years will help the company produce a more comprehensive road map for how sustainability can be carefully integrated and aligned with strategy. In other words, there is now an opportunity to develop a clear long-term plan for how sustainability can be a core component of ICT and business planning life cycles. Despite growing in terms of employees, transactions and revenues over the years, it is evident that the focus on sustainability projects has ensured that resource consumption associated with operations has grown at a significantly slower pace\(^{10}\). The company has managed to significantly reduce CO\(_2\) emissions per employee. In 2010, CO\(_2\) emissions (scopes 1 and 2) per employee amounted to 3,724kg while in 2014 this figure was reduced to 3,331 kg, an overall reduction of 11%. Similarly, the implementation of solutions such as the Amadeus Environmental Management System (EMS) has led to several positive outcomes, which 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 the achievement of best practices.

**Lesson 2: Sustainable ICT initiatives offer opportunities to enhance competitive branding**

The findings suggest that Amadeus is now perceived as 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 adopting sustainability initiatives are rewarded with increased profit and market share. Mithas et al (2010) suggested that sustainable ICT has the potential to impact firm profitability by impacting revenue growth, cost reduction, risk reduction and winning the environmentally-conscious segments of the market. Firms with higher sustainable ICT spending can differentiate their products from that of competitors based on their environmentally-friendly branding (Dangelico and Pujari, 2010, Shrivastava, 1995). Lyon and Shimshack (2015) recently analyzed the impact of an environmental rankings scheme for a sample of large companies in US. They found strong evidence that *Newsweek’s* 2009 Green Rankings had a significant impact on rated firms’ capital market performance, with firms in the top 100 obtaining returns that were 0.6%–1.0% 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 with only companies that feature in the top 10% of scorers for each activity sector being able to enter
the index (Amadeus Global Report, 2014). 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, 2014). In 2015 Amadeus’ score in the CDP was 98 (Amadeus Global Report, 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.

**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, staff awareness and engagement needs to be facilitated by effectively communicating the business value of sustainability to employees. Companies should ensure that their sustainable ICT strategy is aligned with other organizational 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 in development of CSR initiatives very early on. CSR decisions are usually made by senior managers (Brammer and Millington, 2003, Burton and Goldsby, 2009, Treviño et al, 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 successful delivery of sustainability commitments depends on buy-in not just from senior management, but from staff across the firm (Lyon, 2004). By involving employees early on in decisions,
managers could promote positive identification with corporate values and encourage staff commitment to sustainability strategies (Maclegan, 1999).

Limitations

It is also important to note the current study is not free of limitations. The interviews with staff to gauge their level of awareness and engagement was conducted in 2012 and since then Amadeus IT Group has significantly increased investment 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 has not captured. Further research is required 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 beyond.

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. This exploratory study 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. It mainly investigated the current capability maturity level of sustainable ICT within 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.
References


Jarrell J. (2016). Difficult questions you should ask your current CUTE/CUPPS provider, Amadeus ACUS positioning paper.


Appendix: Interview Questions

Participant's knowledge of Sustainable ICT:
- Do you know what Sustainable ICT refers to?
  - If not a definition of Sustainable ICT with specific examples was provided to the participants.

Sustainable ICT in Amadeus IT Group:
- Are you aware of Sustainable ICT initiatives within Amadeus IT Group?
  - Cooling Data Centres
  - 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 within 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’ 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’ Sustainable ICT strategy?
- What does it mean to you to be part of a company involved with Sustainable ICT capability?