
12th Italian LCA Network Conference

**Life Cycle Thinking in decision-making
for sustainability:
from public policies to private businesses**

**Messina
11-12th June 2018**

**Edited by: Giovanni Mondello, Marina Mistretta, Roberta Salomone
Arianna Dominici Loprieno, Sara Cortesi, Erika Mancuso**



Italian National Agency for New Technologies,
Energy and Sustainable Economic Development



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Proceedings of the 12th Italian LCA Network Conference

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Conference program

JUNE 11th, 2018 - Monday

08.30 - 09.00 **Registration to Italian LCA Network Conference**

09.00 - 09.30 **Italian LCA Network Conference - Opening ceremony**

Salvatore Cuzzocrea - *Rector of the University of Messina*

Augusto D'Amico - *Director of the Department of Economics*

Maurizio Cellura - *President of the Italian LCA Network*

Roberta Salomone - *Conference Chair*

09.30 - 11.00 **SESSION I (in Italian language)**
LCA, LOCAL GOVERNMENTS, AND CIRCULAR ECONOMY

Chairs: Maurizio Cellura – University of Palermo

Giuseppe Saija – University of Messina

EU Policies for ENERGY Research: the SET Plan and the new 2018-19 Horizon 2020 Work Program

Riccardo Basosi – *Italian Permanent Representative H2020 Energy EU Programme and MIUR Delegate in the SET Plan Steering Committee*

Life Cycle Assessment of electrochemical storage technologies

Marco Ferraro – *CNR-ITAE*

European Environmental Footprint methods: status update and future outlook

Michele Galatola – *European Commission - DG Environment - Sustainable Production, Products & Consumption*

The Accredia's experience in environmental conformity assessment, supporting LCA-based activities

Filippo Trifiletti – *General Director ACCREDIA*

11.00 - 11.30 Coffee break

11.30 - 13.00 **SESSION II**
ENERGY AND BUILDING

Chairs: Giuseppe Ioppolo – University of Messina

Marina Mistretta – Mediterranea University

Comparative LCA of renovation of buildings towards the nearly Zero Energy Building

Grazia Barberio – *ENEA*

Life Cycle Analysis of an innovative component for the sustainability in the building sector

Maria Laura Parisi – *University of Siena*

Life Cycle Assessment of building end of life

Serena Giorgi – *Politecnico of Milano*

ELISA: A simplified tool for evaluating the Environmental Life-cycle Impacts of Solar Air-conditioning systems

Sonia Longo – *University of Palermo*

A comparative study between a Prefab building and a Standard building for the characterisation of production and construction stages

Mónica Alexandra Muñoz Veloza – *Politecnico of Torino*

Energy saving in LT/MT transformers

Simone Maranghi – *University of Siena*

13.00 - 14.00 Lunch

14.00 - 15.00 Poster Session

15.00 - 16.30 **SESSION III
AGRI-FOOD APPLICATIONS**

Chairs: Bruno Notarnicola – University of Bari “Aldo Moro”

Roberta Salomone – University of Messina

Steps towards SDG 4: teaching sustainability through LCA of food

Nicoletta Patrizi – *University of Siena*

The blue water use of milk production in North Italy – a case study

Doriana Tedesco – *University of Milan*

Practitioner-related effects on LCA results: a case study on Energy and Carbon footprint of wine

Emanuele Bonamente – *University of Perugia*

Environmental impacts and economic costs of nectarine loss in Emilia-Romagna: a life cycle perspective

Fabio De Menna – *University of Bologna*

Grana Padano and Parmigiano Reggiano cheeses: preliminar results towards an environmental eco-label with Life DOP project

Daniela Lovarelli – *University of Milan*

Life Cycle studies in agrifood sector: focus on geographical location

Anna Mazzi – *University of Padova*

16.30 - 17.00 Tea break

17.00 - 17.30 **YOUNG RESEARCHER AWARDS**

Chairs: Grazia Barberio – ENEA

Andrea Raggi – University “G. d’Annunzio”

Environmental implications of future copper demand and supply in Europe

Luca Ciacci – *University of Bologna*

Multifunctional agriculture and LCA: a case study of tomato production

Cristian Chiavetta – *ENEA*

Development of a method to integrate particular matter formation in climate change impact assessment

Andrea Fedele – *University of Padova*

17.30 - 18.30 **ITALIAN LCA NETWORK CONFERENCE ASSEMBLY**

18.30 - 20.00 Free time

20.00 Bus transfer to Gala Dinner

20.30 - 22.30 Gala Dinner – *Villa Ida*

JUNE 12th, 2018 - Tuesday

9.30 - 11.00 **SESSION IV**
LIFE CYCLE THINKING METHODS AND TOOLS

Chairs: Grazia Barberio – ENEA
Serena Righi – University of Bologna

A case study of green design in electrical engineering: an integrated LCA/LCC analysis of an Italian manufactured HV/MV power transformer

Emanuela Viganò – CESI S.p.A.

Eco-design of wooden furniture based on LCA. An armchair case study

Isabella Bianco – Politecnico Torino

Life Cycle Thinking in online accommodation booking platforms: making a more sustainable choice

Ioannis Arzoumanidis – University “G. d’Annunzio”

Matching Life Cycle Thinking and design process in a BIM-oriented working environment

Anna Dalla Valle – Politecnico Milano

Lithium-ion batteries for electric vehicles: combining Environmental and Social Life Cycle Assessments

Silvia Bobba – Politecnico Torino

State of art of SLCA: case studies and applications

Gabriella Arcese – University of Bari “Aldo Moro”

11.00 - 11.30 Coffee break

11.30 - 13.00 **SESSION V**
WASTE MANAGEMENT

Chairs: Anna Mazzi – University of Padova
Marzia Traverso – RWTH Aachen University

Life cycle assessment applied to biofuels from sewage sludge: definition of system boundaries and scenarios

Serena Righi – University of Bologna

Analysis of a recycling process for crystalline silicon photovoltaic waste

Fulvio Ardente – European Commission - Joint Research Centre

Environmental comparison of two organic fraction of municipal solid waste liquid digestate’s management modes

Federico Sisani – University of Perugia

Life Cycle Thinking for Food waste management alternatives, an experience in Costa Rica

Laura Brenes-Peralta – University of Bologna/Researcher Instituto Tecnológico de Costa Rica

The way towards sustainable policies: combining LCA and LCC for construction waste management in the region of Flanders, Belgium

Andrea Di Maria – KU Leven

Highlighting food waste in school canteens: a preliminary assessment of the associated environmental and economic impacts

Laura García-Herrero - University of Bologna

13.00 - 14.00 Lunch

14.00 - 15.00 Poster Session

9.30 - 11.00

**SESSION VI
LIFE CYCLE THINKING METHODS AND TOOLS**

Chairs: Marco Ferraro – CNR-ITAE

Giuseppe Tassielli – University of Bari “Aldo Moro”

The Constructal Law to optimize performances of energy systems through the Life Cycle approach

Francesco Guarino – University of Palermo

Walk-the-talk: Sustainable events management as common practice for sustainability conferences

Rose Nangah Mankaa – RWTH Aachen University

A Preliminary LCA Analysis of Snowmaking in Fiemme Valley

Paola Masotti – University of Trento

Life Cycle Assessment of a calcareous aggregate extraction and processing system

Rosa Di Capua – University of Bari “Aldo Moro”

Efficient Integration of Sustainability aspects into the Product Development and Materials Selection Processes of Small Businesses

Jonathan Schmidt – RWTH Aachen University

Bioplastics in designing beauty and home packaging products. A case-study from Aptar Italia SpA

Michele Del Grosso – APTAR Italia SpA

16.30 - 17.00 Tea break

17.00 - 18.20

**ROUND TABLE
LIFE CYCLE THINKING IN DECISION-MAKING FOR SUSTAINABILITY:
FROM PUBLIC POLICIES TO PRIVATE BUSINESSES**

Moderators: Maurizio Cellura – University of Palermo

Bruno Notarnicola – University of Bari “Aldo Moro”

Methodological advancements and remaining challenges after 5 years of Environmental Footprint road field testing

Michele Galatola – European Commission - DG Environment - Sustainable Production, Products & Consumption

Life Cycle Thinking in the U.S. Public Policy

Sangwon Suh – University of California

Life cycle based environmental assessment of EU consumption

Serenella Sala – European Commission - Joint Research Centre - Directorate D – Sustainable Resources, Bio-Economy Unit (D1)

18.30 Bus transfer to Regional Museum

19.00 - 21.30 Guided tour of the regional Museum and Light Dinner

Life Cycle Thinking in online accommodation booking platforms: making a more sustainable choice

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Abstract

The rise in tourism arrivals and the need for the achievement of sustainability goals have also caused an ever-growing attention towards sustainable tourism. Recently, online platforms and tour operators have become one of the most common means of booking in tourism and they can play an important role for the promotion of sustainable tourism. The objective of this paper is to identify to what extent and how the concept of sustainability can be integrated within these websites and whether this has already been done. Additionally, a set of life-cycled-based indicators is aimed to be identified or proposed for the selection of sustainable accommodation within these websites. Tourists would therefore be assisted when it comes to choosing the most sustainable option of accommodation, in the same way as they can already do today when selecting the most convenient fare or the most suitable location and features.

1. Introduction

Recently, tourism arrivals reached a total of 1,322 million worldwide in 2017 (UNWTO, 2018) and they are expected to increase by 3.3% a year between 2010 and 2030 to reach 1.8 billion by 2030 (UNWTO, 2017a). Furthermore, the need for achieving the sustainability goals has also caused an ever-growing attention towards sustainable tourism. Recently, online platforms and tour operators have become one of the most common means of booking in tourism (Dutta and Manaktola, 2009). Although most of sustainability challenges depend on human behaviour (Baddeley and Font, 2011), it is this behaviour that can be aided and guided when it comes to making the right choices -a “nudge” as described by the Nobel laureate Thaler (Thaler et al., 2014)-, e.g., selecting an environmentally friendly or so-called “green” hotel through the interface of an online booking platform.

Most of the sustainability-related impacts in tourism take place throughout the supply chain of a tour operator (Schwartz et al., 2008). Life Cycle Assessment (LCA) is a robust and standardised methodology that follows the concept of Life Cycle Thinking and helps evaluate the environmental impact of goods and services throughout their supply chain. This can also be of help to select the most environmentally sound choice between two or more options (ISO, 2006). Tourism is one of the sectors where LCA has been increasingly studied by the scientific community (De Camillis, 2010). This is also because tourist activities can be considered as a global power towards a local economic development, particularly for some regions of the world (Hsieh and Kung 2012; Rizzi and Graziano, 2017). Finally, there is a great number of eco-labels in tourism (De Camillis, 2010), which can be somehow confusing for the final users.

This paper builds on previous research (Raggi et al., 2018) and has a twofold objective. One aim is to identify to what extent and how the concept of sustainability can be (or has already been) integrated within accommodation booking websites. Additionally, even though the identification or proposal of sustainability indicators for the tourism sector is quite common (see, for example, Agyeiwaah et al., 2017), an attempt will be made here to identify a set of life-cycle-based indicators for the selection of environmentally-sound accommodation within these websites.

This paper is structured as follows: in Section 2 the methods and strategies for the analysis of this study are described in detail. In Section 3 the results obtained are presented and discussed. Finally, some conclusions are drawn in Section 4.

2. Materials and Methods

The first objective required the identification of the extent and the way the concept of sustainability can be integrated within online booking websites and whether this process has already started. This was addressed by means of a literature review and via the analysis of the websites, as it will be described hereafter.

A literature review was performed in order to identify whether the concept of sustainability has been tackled so far by online booking platforms and tour operators. This was carried by searching the Scopus and WebOfScience databases. The keyword combinations used for the literature search included: (“online booking” OR “online platform”) AND (“hotel*” AND “accommodation” AND “hospitality”) AND (“sustainab*” OR “environmen*”); and (“online platform” OR “tour operator*”) AND “sustainab*”, in the fields of article title and abstract. The results were then evaluated with regard to their relevance to the topic. The screening resulted in 8 scientific contributions. The results of the literature review are presented in Section 3.1.

The second part of the analysis concerned the online booking platforms. The aim here was to explore whether the existing platforms have somehow incorporated the concept of sustainability. Initially, a set of platforms had to be identified from the vast number of existing ones. This was performed through a selection procedure. The hypothesis made was that in order to depart for an overnight trip one needs to book for an accommodation; thus, the number of visits to online booking platforms is assumed to be related to the number of trips. Based on the available statistics, the number of trips for each country of the world was calculated as the sum of the domestic trips of overnight visitors (UNWTO, 2017b) and the departures from the country of usual residence to any other country (World Bank, 2017), for 2015. The results showed the countries with the most trips¹², which included (in order of magnitude): India, Japan, Germany, France, United Kingdom, Spain, Canada, South Korea, Australia, Poland, Turkey, Italy, Saudi Arabia, Netherlands, Finland, Argentina, Hungary,

¹² The databases do not always provide data for all countries of the world. In this study, the analysis was performed for the countries for which there was available data.

Czechia, Romania, Chile, Austria, Switzerland, Belgium, Ireland, Venezuela, Ecuador, Greece, Georgia, Uruguay, Bulgaria, Croatia, Latvia, Lithuania, Slovenia, Estonia, Cyprus, Armenia, Swaziland, Luxembourg, Zimbabwe, Belarus, Malta, Moldova, Tajikistan (Raggi et al., 2018). The ones that cumulatively made up a percentage of more than 80% of the total trips were considered (India, Japan, Germany, France, United Kingdom, Spain, Canada, Australia, Poland and Turkey)¹³.

Then the most visited websites for online accommodation booking for the previously identified countries were identified. This was accomplished using a research service for online marketing (Semrush, 2018), through the search option for competitors for one of the platforms¹⁴. This provided detailed results for the traffic (number of visits) of online booking websites performed through the Google research engine for all the selected countries. Once the various traffic-related visits were summed up, the 10 most visited websites were identified (Booking, 2018; Cleartrip, 2018; Etstur, 2018; Expedia, 2018; Holidaycheck, 2018; Hotels, 2018; Kayak, 2018; Makemytrip, 2018; Tripadvisor, 2018; Trivago, 2018).

In the third step, the selected websites were analysed in order to identify whether they had included the concept of sustainability. This was performed by (a) visiting the websites and trying to perform a test search for accommodation; and (b) searching in the web (by using the Google search engine) for sustainability-related issues regarding those websites. As far as (a) is concerned, the procedure included a search for the keywords “sustainable”, “sustainability”, “environment” or “green” in three different phases of a normal booking process, that is: i) the home page of the website; ii) the page with the resulting list of accommodation proposals¹⁵; iii) the page of selected accommodation. Regarding (b), the search was conducted to understand whether the specific platforms were somehow involved in schemes, promotions or awards concerning sustainability issues. The results of this analysis are presented in Section 3.2.

The second objective of this study was to identify whether any life cycle-related indicators could be identified for the sector. This was performed via another review of the scientific literature. As with the first review, this was carried out searching the Scopus and WebOfScience databases. The used keyword combination included: “indicator*” AND “life cycle” AND “environment*” in the field of article title; and “indicator*” AND (“LCA” OR “Life Cycle Assessment”)

¹³ The initial list included South Korea instead of Poland and Turkey. However, no data were found regarding the Korean internet traffic towards the various online booking platforms. For this reason, this country was substituted by the next ones in the classification, until the 80%-trip minimum threshold was reached.

¹⁴ The cited service compares different competitor websites in terms of their common keywords. This was done in order to include all possible online booking platforms for each country (both local and international) and not to be limited to a list of platforms that would have been set *a priori*.

¹⁵ During the test search performed, the same destination city (Rome) and days of overnight stay (November 11th to November 12th, 2017) were selected for all websites.

AND (“touris*” OR “accommodation”) in the fields of article title and abstract. The results were then evaluated with regard to their relevance to the topic. The screening¹⁶ resulted in 6 papers, which are presented in Section 3.3.

3. Results and Discussion

3.1. Literature review on sustainability and online booking platforms and tour operators

The review on whether sustainability has been tackled so far by online booking platforms and tour operators (see Section 2) resulted in 8 scientific contributions: seven journal articles (Schwartz et al., 2008; Sigala, 2008; Dutta and Manaktola, 2009; Baddeley and Font, 2011; Nicoli and Papadopoulou, 2017; Ponnappureddy et al., 2017; Tasci, 2017) and one book chapter (Hamid and Isa, 2017).

A general result to be highlighted is the scarcity of the findings. Indeed, none of the reviewed papers reports any case of online booking platform having actually implemented sustainability issues. Nevertheless, some of the identified articles try to define what sustainable tourism actually is, as well as the importance of the online tour operators and booking platforms and in promoting it. Furthermore, the choice of a sustainable accommodation was found to be dependent on socio-demographic factors or be somehow unintentional/incidental (Ponnappureddy et al., 2017; Tasci, 2017). The practices towards a sustainable tourism development may require several approaches, such as Supply Chain Management (Schwartz, 2008; Sigala, 2008; Hamid and Isa, 2017) and Corporate Social Responsibility (Dutta and Manaktola, 2009; Hamid and Isa, 2017). Furthermore, the importance of the companies' awareness of their potential to promote (or not) sustainability issues is highlighted (Schwartz, 2008; Dutta and Manaktola, 2009). The issue of a sustainable Supply Chain Management (SCM) in tourism is stressed also from the difficulty a company may face when trying to persuade its external contractors or suppliers to gather and report all the necessary information (Sigala, 2008). Nonetheless, a successful sustainable SCM may be hindered by cultural and/or political issues affecting a country (ibid.). Moreover, the need for use of SCM sustainability indicators in the sector is underlined (Schwartz, 2008; Baddeley and Font, 2011; Hamid and Isa, 2017). Finally, since the customers' review schemes used by some online booking platforms were found to be able to determine the reputation of a hotel (Nicoli and Papadopoulou, 2017), they can be used ideally for the promotion of sustainable tourism.

3.2. Analysis of the identified booking platforms

The analysis of the identified online booking platforms (Section 2) was twofold. Firstly, the interface of the various websites was taken into account. A careful examination showed that in 8 cases out of 10, the platforms did not provide any information regarding the environmental-friendliness or sustainability) of the

¹⁶ The screening process for the general review on life cycle indicators for the environment was performed for articles tackling this issue not limited to only one economic sector.

hotels, etc. This was identified both regarding the research filters and within the selected accommodation solution as well as their home page. Only one of the websites provided the option to search for “green” accommodation. Nevertheless, this was not a direct option from the home page, rather a filter that could be selected once the list of available hotels, hostels etc., had been obtained. Furthermore, once a “green” hotel had been selected, more information could be found on its platform-related webpage under a green leaf logo. This information was related to a hotel award scheme of the specific website, which will be described below. Finally, two of the platforms were found to be only available in languages other than English. The first one was in German and was evaluated; the second one was in Turkish and it was excluded from this analysis due to lack in understanding it. For a schematic representation of the results, please refer to Fig. 1.

The second part of the analysis included the search of sustainability-related issues for the identified websites. For four platforms no results emerged; two of them included dedicated pages on “green” accommodation, one specifically on “green” hotels and its own award scheme and the other on how to reduce one’s carbon footprint by donating money to an environmental promoter in India.

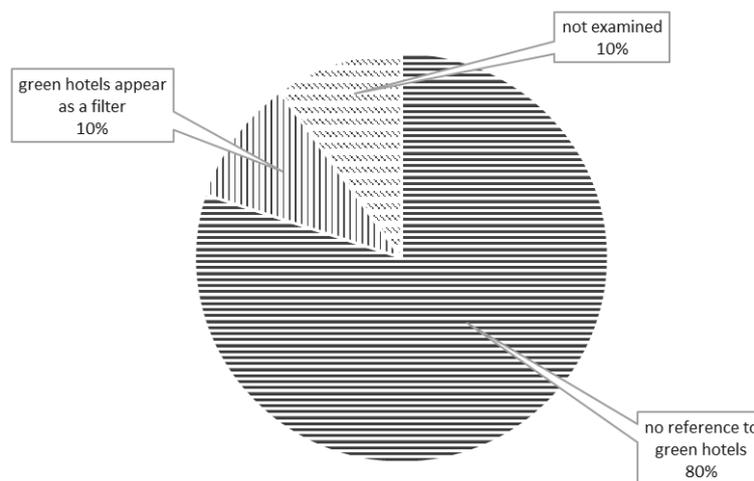


Figure 1: Green accommodation within online platforms

The award scheme of the first one consists of four badge levels: bronze to platinum. These are appointed in terms of a property’s level of participation in environmentally-friendly activities. The indicators used for these awards comprise energy efficiency, waste management, water use, purchasing, education of the public on these issues, innovation. A third site also had an environment-dedicated website, which did not appear to be working during this analysis. Finally, two websites had separate domains (e.g., blogs) related to sustainability issues and their promotion. One of them specifically promotes an accelerator programme for new start-ups to stimulate sustainable tourism. The other one specifically stresses the importance of some hotels’ sustainability initiatives.

However, once on the webpage of the hotel, no relevant information could be found whatsoever. For a schematic representation of the results¹⁷, please refer to Fig. 2.

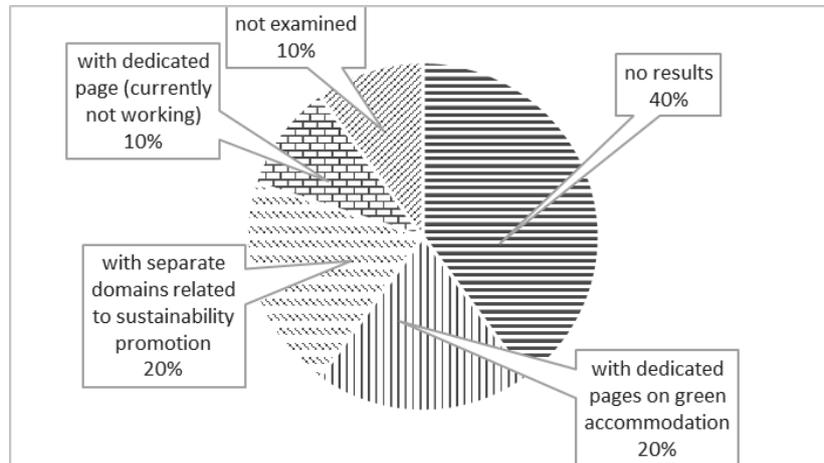


Figure 2: Sustainability-related issues of online platforms, e.g., awards, blogs etc.

3.3. Review on life-cycle indicators for tourism

The review on whether there were life cycle-related indicators that could be proposed for the tourism sector (Section 2) resulted in 6 scientific contributions, five journal articles and one PhD thesis.

It can be noted that this issue has been tackled with poorly so far. The screening procedure for this review provided a few articles, which however tackled the issue only marginally. Indeed, two articles (Kulkajonplun et al., 2016; Puig et al., 2017) actually propose sustainability-related indicators, e.g., loss of biodiversity, land management, atmospheric carbon emissions, energy use, and climate change. Kalbar et al. (2017) propose using a sum of indicators, e.g., accommodation, thermal energy, electricity, road transport, air travel, and food, or alternatively the use of a single indicator, i.e., carbon footprint (CF) for the residences (possible application to the tourism sector). The use of a single indicator (CF) is also proposed by Filimonau (2011). In this case, the proposed indicator is, indeed, life cycle-based. Finally, Michailidou et al. (2017) proposed the use of LCA along with Tourism Environmental Composite Indicator for a Defined Area of Concentrated Tourism, including energy-, water-, waste- and carbon footprint-related indices.

A general look at the use of environmental life-cycle indicators was made by Steinmann et al. (2016), who propose using a minimum number of indicators in a “one-size-fit-all” solution of 6 indicators: climate change, ozone depletion,

¹⁷ During this search, another website came out that declared to promote “green” accommodation. Since it was not amongst the websites resulting from the selection procedure, it was not considered in Fig. 2, although it was still analysed. This website proposed a series of “green” solutions in the globe. On the hotel page, however, no additional information was provided regarding why a hotel was considered to be “green”.

acidification and eutrophication, terrestrial ecotoxicity, marine ecotoxicity and land use, accounting for 92% of the variance of the analysed product rankings. A restriction to 84% of the variance provides a set of 4 indicators (energy, water, land, materials). However, tourism was not explicitly cited.

4. Conclusions

This paper aimed at examining whether the concept of sustainability can be integrated within online accommodation booking websites and whether this process has already started. The literature review that was carried out showed that this issue has not been tackled with so far. An analysis of selected platforms confirmed this statement, with few exceptions where “green” accommodation was either proposed, via special webpages, filters within the incorporated search engines or affiliated blogs, or awarded for the hotels that promoted it. Another objective was to try to identify life cycle-based indicators that could be suitable for the selection of environmentally-sound accommodation within these websites. This also resulted to be a poorly tackled issue. The promotion of a life-cycle indicator emerged only via the proposal of a single indicator or a set of indicators (for general use). Future developments would thus include the identification or the proposal of a set of indicators that would be suitable for the sector and helpful for users when booking online for accommodation to make more sustainable choices. Even though the concept of sustainability has been inadequately introduced in online booking platforms so far, there is still plenty of room for both its integration and dissemination. This article can be a basis for future tourists to help them select a more sustainable accommodation via online booking platforms, and thus reduce the overall environmental impact of the sector.

5. References

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