ATTI

XIV Convegno della rete Italiana LCA
IX Convegno dell'Associazione Rete Italiana LCA

La sostenibilità della LCA tra sfide globali e competitività delle organizzazioni

Cortina d'Ampezzo
9-11 dicembre 2020

A cura di Erika Mancuso, Sara Corrado, Arianna Dominici Loprieno, Laura Cutaia

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AGENZIA NAZIONALE PER LE NUOVE TECNOLOGIE, L'ENERGIA E LO SVILUPPO ECONOMICO SOSTENIBILE

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ISBN: 978-88-8286-416-3

2021 ENEA
Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile

Copertina: Flavio Miglietta
Stampa: Laboratorio Tecnografico ENEA - Centro Ricerche Frascati

Measuring circularity in the tourism sector: a step forward

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Abstract

The tourism industry is one of the fastest-growing economic sectors, thus contributing to ever-increasing sustainability-related impacts. Within this sector, the concept of circularity has been poorly analysed so far. This paper aims at providing some insight towards the measurement of circularity in tourism by means of a literature review. The results showed that the measurement of circularity can be complex and that life cycle-based indicators have started to be introduced. With regard to tourism, only one set of indicators, which partially overlap with the ones proposed by the EU monitoring framework towards Circular Economy, was identified. Those proposed within in the EU framework were found to be appropriate for the tourism industry; however, not all of them could be regarded as life cycle-based. A next step will be to analyse and integrate life cycle sustainability-based indicators with circularity ones.

1. Introduction

The tourism industry can be identified as one of the fastest-growing economic sectors. Indeed, the number of global tourism arrivals reached 1.5 billion in 2019 with an increase of 4% with respect to 2018 (UNWTO, 2020)[10]. Until now, the intense growth of the industry has led to ever-increasing environmental (Manniche et al., 2018) as well as social and economic impacts (Tasci, 2017). The EU adopted a sustainable development stance -- highlighted also by the United Nations (UN, 2016) -- thus indicating the transition to Circular Economy (CE) amongst its priorities (EC, 2015). According to this concept, the value of products as well as of materials and resources should be maintained as long as possible within the economy, while waste is to be minimised (Pamfilie et al., 2018).

After an in-depth analysis of the CE concept, scholars shifted their focus from measuring the circularity of products (e.g., Niero & Kalbar, 2019), companies (Prieto-Sandoval et al., 2018), supply chains (e.g., Howard et al., 2019), and regions (e.g. Geng et al., 2012) towards assessing the correlation of CE metrics and potential sustainability impacts (Helander et al., 2019; Kravchenko et al., 2019; Kristensen & Mosgaard, 2020). It is no longer enough to be circular for the

[10] It has to be noted, though, that such a growth could be compromised in 2020 due to the coronavirus infection (COVID-19), which has been spreading all over the globe (Oxford Analytica, 2020; Ruiz Estrada et al., 2020).

sake of circularity, but it is also important to be aware of the potential sustainability implications following the transition towards a CE.

When it comes to the tourism industry, the concept of circularity was found to be somewhat poorly analysed to date, although it has slowly been introduced in the hospitality subsector within practical applications (Arzoumanidis et al., 2020). In the same way as with CE, the concept of a Circular Tourism (CT) would be able to include the stimulation of circular flows with the goal of conciliating tourism and sustainable resource management (Patti, 2017).

This paper aims at providing some insight towards the measurement of circularity in tourism by means of a literature review, as required by the AIM project (please refer to the "Acknowledgements" section) with an outlook towards sustainability. In this way, a set of life cycle-based indicators will eventually be identified at a later stage of the project in order to be used in online booking platforms and to assist future users in making more sustainable choices. Given this final use of such indicators, these should meet criteria, such as: be scientifically robust, easy/simple to calculate and/or use for both accommodations and clients, etc.

2. Circular Economy indicators

The first assessment frameworks for a circular economy came from Chinese authors, given that China had implemented policies on a CE already in 2003 (Geng et al., 2012). Their CE concept was largely based on the field of industrial ecology, which had been rebranded. Therefore, measurement approaches were similar to those used for evaluating the efficiency in industrial symbiosis (e.g., Wen and Meng, 2015). Indeed, Corona et al. (2019) and Moraga et al. (2019) describe that a majority of the methodologies used are mass balance approaches such as Material Flow Analyses (MFAs) and Life Cycle Assessments (LCAs). The latter are especially applied to establish the potential impact of a product on the environment. In the case of Niero and Kalbar (2019), the LCA is combined with the Material Circularity Indicator, developed by the Ellen MacArthur Foundation and Grata (2015), to also determine the circularity of the respective product. In similar vein, Mondello et al. (2020) examined the usefulness and suitability of the LCA methodology in aiding companies in CE decision making processes. While these authors are some of the few combining circularity and sustainability, there are others (Fiksel and Bakshi, 2010; Howard et al., 2019; Linder et al., 2017; Saidani et al., 2019), where the assessment goal is the degree of circularity, rather than the effect this circularity has on sustainability aspects. As mentioned in the introduction however, scholars now divert towards integrating more sustainability-based measures into the measurement of circular systems.

Whereas the aforementioned authors could help establish whether a given system is circular or not - with assessment toolkits that go beyond those used in industrial ecology - there is still the need to establish what the implications of this circular system are on the environment. For this, single indices as proposed are not sufficient, since they are not able to capture systemic impacts. Kristensen & Moosgard (2020) found that circularity indicators mostly focus on recycling, remanufacturing or end-of-life management, while some address disassembly,

resource-efficiency or reuse, lifetime extension, waste management. Yet, most of the indicators are addressing the economic dimension of sustainability, followed by the environmental one, while the social dimension is very limited. Through the partial depiction of potential sustainability impacts of circular systems, current measurement practices are bound to lead towards burden-shifting between the three dimensions (Corona et al., 2019). In line with this finding, from their review of measurement approaches at the micro level and the analysis of the European CE monitoring framework, Moraga et al. (2019) derive that the circularity measurement needs include at least a set of indicators to meaningfully capture realities.

One of the reference frameworks for policy makers is the CE monitoring framework introduced by the EU to assess the advancement towards a CE on a regional level (EC, 2018). These macro-level indicators cover four topics: production and consumption, waste management, secondary raw materials, as well as competitiveness and innovation. In total, the EU proposes ten indicators, including several sub-indicators which are based on Eurostat, the Resource Efficiency scoreboard and Raw Materials scoreboard, in line with the priority areas of the EC Action plan (EC, 2015). The indicators include: EU self-sufficiency for raw materials, green public procurement, waste generation, food waste, overall recycling rates, recycling rates for specific waste streams, contribution of recycled materials to raw materials demand, trade in recyclable raw materials, private investments, jobs and gross value added, and patents. While constituting one of the most commonly agreed indicator sets, many of the EU indicators are not based on Life Cycle Thinking (LCT), as suggested by Corona et al. (2019) and Moraga et al. (2019).

3. Circular Tourism indicators

Measuring the circularity of tourism is a special case, given that the product in tourism is not a good, but a service. Indeed, besides the Product Service Systems, where a good is marketed as a service, while the ownership resides with the production or retailing company (Tukker, 2015), there has been limited research on measuring circularity of the service sector. Most of the aforementioned sources focus on manufacturing companies. In comparison to other sectors, tourism is geographically delimited and connects supply chains of goods as well as services which renders assessment approaches such as LCA of services and products a suitable option (De Camillis et al., 2010). Scheepens et al. (2016) were the first to apply two LCA-based methodologies to the tourism sector, namely the Eco-costs Value Ratio Model to analyse potential environmental impacts of business initiatives as well as the Circular Transition Framework, covering the whole product life cycle to help understand what forms the complex design of circular business models could take, and how these business models can be introduced into water tourism.

As far as the use of indicators for the measurement of circularity in tourism is concerned, a literature review[11] was performed explicitly for their identification; this resulted in only three scientific articles, where such indicators were explicitly cited. Even within these few identified articles, two of them (Girard and Nocca, 2017; Paulauskas, 2018) only highlighted the need for a set of indicators for CT, whilst the third one (Zhao and Tao, 2011) went on to define an eventual set. Following a decision-making process with the support of a panel of experts and via the Analytic Hierarchy Process (AHP) and the Delphi method, Zhao and Tao (2011) proposed the use of 8 indicators for CT (specifically for tourism spots), namely: resource use efficiency, recycling rate, environmental protection of resources, environmental monitoring and certification, economic importance, tourism revenue, management efficiency and social benefits. The proposed indicators recall the ones set by the EU framework in terms of resource use efficiency, recycling rate and social benefits.

Given the limited literature found on circularity measurement, the connection between the indicators of the EU framework and general tourism performance assessment is analysed by looking for a possible link to sustainability assessment in tourism via a content analysis. At a first glance, all EU framework-proposed indicators appear to be suitable for the tourism industry as they deal with themes such as: production and consumption, waste management, secondary raw materials management, competitiveness and innovation initiatives. After examining those indicators in terms of their suitability for the tourism industry, they were found to be somewhat linked to it and therefore they could be used in such a framework, e.g., raw materials self-sufficiency (Tigu and Calaretu, 2013); green public procurement (Rogerson and Rogerson, 2019); waste generation (Saito, 2013); food waste (Curtis and Slocum, 2016); recycling rates & recycling rates for specific waste streams (Trang et al., 2015); recycled materials (Construction Europe, 2010); recyclable materials (Chaabane et al., 2019); private investments, jobs, growth (Council of the European Union, 2019); patents (Succurro and Boffa, 2018).

As far as life cycle-based circularity indicators for tourism are concerned, these were not directly proposed by any of the identified scientific articles above. Furthermore, according to Moraga et al. (2019), not all the EU framework-proposed indicators can be regarded as life cycle-related. Indeed, indicators are believed to be life cycle-related, if (ibid.): (i) they measure physical properties from the technological cycles with full or partial LCT approach. These may include *recycling of e-waste*, and *recycled materials for raw materials;* (ii) they measure the effects (burdens/benefits) from technological cycles regarding environmental, economic, and/or social concerns in a cause-and-effect chain modelling. These may include *recyclable raw materials*, *private investments, jobs, growth* and *patents*. In addition, life cycle indicators could be identified through sets of scientifically-sound sustainability-related indicators that are currently used by LCA and Social LCA practitioners. Indicator categories, which have been used or

[11] The literature review was carried out by using the following keyword combination on EBSCO Discovery Service: touris* (in title) AND indicator* (in title/abstract) AND circular* (in title/abstract).

highlighted as hot-spots by tourism LCA practitioners, are e.g., climate change, acidification, nutrient enrichment, photochemical oxidants (Filimonau, 2016). For a summary of the main identified indicators please refer to Table 1.

Table 1: main identified indicators

Indicator	Life cycle-suitability	Tourism-suitability
(Zhao and Tao, 2011)		
resource use efficiency	✓(partially)	✓
recycling rate	✓(partially)	✓
environmental protection of resources	✓(partially)	✓
environmental monitoring and certification		✓
economic importance		✓
tourism revenue		✓
management efficiency	✓(partially)	✓
social benefits	✓	✓
(Filimonau, 2016)		
climate change	✓	✓
acidification	✓	✓
nutrient enrichment	✓	✓
photochemical oxidants	✓	✓
(EC, 2018; Moraga et al., 2019)		

Indicator	Life cycle-suitability	Tourism-suitability
EU self-sufficiency for raw materials		✓
green public procurement		✓
waste generation		✓
food waste		✓
overall recycling rates		✓
recycling rates for specific waste streams	✓(partially)	✓
contribution of recycled materials to raw materials demand	✓	✓
trade in recyclable raw materials	✓	✓
private investments, jobs and gross value added	✓	✓
patents	✓	✓

4. Conclusions

The literature review that was carried out for this article demonstrated that the measurement of circularity is complex and can differ depending on the level of assessment. Furthermore, LCA-based indicators have slowly been introduced into the framework of circularity indicators and research has started to divert towards integrating more sustainability-based measures. Nonetheless, most of the identified indicators were found to address mainly the economic and environmental dimensions of sustainability, thus assessing the social dimension only superficially.

When it comes to CT, only one scientific article was identified, which proposed a set of indicators that partially overlap with the ones suggested by the EU monitoring framework towards CE. The latter were found to be somewhat suitable

for the tourism industry; however, not all of them can be regarded as life cycle-based.

Future developments will include the identification of life cycle-based, scientifically sound and easy-to-use indicators for circularity, to be used along with sustainability-related ones in online booking platforms within the framework of the ongoing project. Indicators for CT could be identified through decision making tools (e.g., AHP) applied to the indicators presented in this paper, together with circularity indicators proposed by other researchers, as for example in Saidani et al. (2019), and the life cycle sustainability-based indicators.

Acknowledgements

The objective of this paper is part of the “AIM - Attraction and International Mobility” project, funded by the European Social Fund and the Italian Revolving Fund (AIM1894803-1).

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