



THE DEVELOPMENT OF THE CIRCULAR ECONOMY IN THE SPANISH TOURISM INDUSTRY: THE ROLE OF TECHNOLOGY START-UPS

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Extended Abstract

Purpose of the paper: *The interest in applying the principles of the circular economy to tourism is certainly recent and is taking place in an environment of technological disruption that can be framed in what is known as the 'revolution 4.0'. In this context, it is evident that new technologies are essential in the way to a new model of circular tourism, as a path towards environmental sustainability.*

Consequently, this paper is situated at the intersection between industry 4.0, circular economy and tourism, with the aim of showing how the technological developments of the fourth industrial revolution are driving the application of the principles of the circular economy, as a branch of the science of sustainability (Geissdoerfer, Savaget, Bocken and Hultink, 2017), in that activity. This approach applied to the tourism sector has gained prominence because of the COVID-19 pandemic, which has accelerated fundamental change dynamics mainly linked to digitalisation and environmental sustainability.

It is clear that the advent of the fourth industrial revolution, the development of technological devices and the Internet are having a profound impact on tourism. In the era of 'tourism 4.0', the digital revolution is changing the behaviour of tourists, businesses and destinations, projecting them towards a 'smart' perspective. As Pencarelli (2020, p. 459) argues, "digitalisation has significantly changed the travel and tourism industry, transforming it into a 'smart' sector; in other words, an innovative and technologically advanced sector that is fully immersed in the paradigm of industry 4.0".

Indeed, 'tourism 4.0' has led to a new management paradigm known as 'smart tourism', which, based on advanced digital space, makes possible the application of a data-intensive logic of all kinds of problems analysis and decision-making to improve the tourist experience and the quality of life of residents in host communities, with the values of innovation and sustainability as guides (Vargas-Sánchez, 2016).

In terms of the transition toward a circular economy model and its application to the tourism industry, the technological revolution referred to (or 4.0) is a key contributor to deepening the application of circular economy principles to tourism. Thus, Mazilescu (2019), in his overview of how emerging technologies can underpin the development of tourism and travel, states that the dematerialisation of the economy will be accelerated through a transition to a circular economy favoured by the new industrial revolution.

For Ramos and Brito (2020), the technological development of 'tourism 4.0' and the circular economy must go hand in hand in order, from the point of view of environmental sustainability, to advance in the fulfilment of the Sustainable Development Goals of the 2030 Agenda of the United Nations Organisation, such as Nos. 11 (sustainable cities and communities), 12 (responsible consumption and production), 13 (climate action), 14 (life below water) and 15 (life on land). In fact, Velenturf and Purnell (2021, p. 1437) position the circular economy "as a technology-focused concept that can generate economic gains while alleviating pressure on the environment".



However, although smart tourism and the circular economy intuitively interconnect, as they both focus on sustainable value creation, their mutual implications have not been sufficiently investigated (Del Vecchio, Malandugno, Passiante and Sakka, 2022).

Methodology: To approach the map of startups related to the circular economy in Spain, the compilation available within the ‘goCircular Radar’ project¹ of ‘TheCircularLab’², promoted by Ecoembes³, has been taken as a reference. In total, 201 companies were registered at the end of March 2022. Most of them were set up from 2017 onwards (81%), with 2020 being the year with the highest number of registrations (23%). The oldest ones are from 2009 (1) and 2010 (1). Concerning their main areas of activity and value chains in which they operate, tables 1, 2 and 3 in the appendix, provide the corresponding breakdown of this population (manufacturing and technology development are their main fields, for instance). Complementarily, concerning their stage in the value chain, their distribution is fairly balanced, namely, in order of importance: recycling and second life (39.8%), eco-design, new materials and manufacturing (31.8%), as well as consumption and general public (28.4%). Table 4, also in the appendix, displays more detailed information (for example, the “Water, food and nutrients” value chain is mainly focused on the stage of “Consumption and the general public”).

A survey was administered to obtain some primary data and have a more comprehensive understanding of the connection between the above-mentioned population of startups in the circular economy sector and the tourism industry, considering, like Silva and Sehnem (2022), that the technologies of industry 4.0 are supporting the implementation of the circular economy. In other words, to which extent this industry (tourism) is part of their business plans, currently and potentially, as services or solutions providers for the application of the circular economy principles, as well as their technology base.

In the questionnaire, with ten items only, the three-first ones are for identification purposes, the three-second ones are devoted to the present, the next three are future-oriented, and a final open item for any comment or clarification. It is evident that the list of technologies relevant to the implementation of circular economy actions could have been longer (Silva and Sehnem, 2022), but respondents had the option to add others to the list proposed.

It was implemented (in Spanish) in Google Forms and sent to companies’ contact emails, available on their websites in most cases. Nonetheless, an English version was also available, that was sent on request. 49 valid (complete) replies were gathered during April 2022, which represents a response rate of 24.4%.

Most of the respondents (63.3%) occupy the position of CEO/Managing Director (the remaining are responsible for a functional area, with marketing as the most outstanding one). Most of the companies in the sample (73.5%) are microenterprises with fewer than 10

¹ Launched in 2021, this project is conceived as an open innovation community for startups and entrepreneurs in the circular economy sector. This community aims to bring together startups that, related to the circular economy, have a clear focus on innovation. The requirements are threefold: to be established and be less than 10 years old; to have a high level of innovation in their products or business models; and to offer a portfolio of solutions that can contribute to the circular economy (<https://radar.thecircularlab.com/>).

² ‘TheCircularLab’ (<https://www.thecircularlab.com/en/>), born in 2017, is defined as an open innovation centre specialised in the circular economy.

³ Ecoembes (<https://www.ecoembes.com/>) is a non-profit business-based organisation, created in 1996, whose mission is to provide society with a collective response from economic agents to environmental issues related to the consumption of household packaged products, achieving compliance with the objectives set by law, with the greatest efficiency in the use of the company's resources.



employees; only 2% are medium-sized enterprises with a staff headcount between 50 and 250; the remaining 24.5% correspond to small companies that are in between (10-49 employees).

Main Findings: About the current connection between these circular economy startups and the tourism industry, only 40.8% responded positively, that is, having any tourism company/organization in their clients' portfolio. In this first cluster, 60% of respondents were their CEOs/Managing Directors (when they occupy a functional position, the marketing/commercial area has been the predominant). 70% of these startups are microenterprises with fewer than 10 employees; 25% corresponds to small companies counting with a number of employees between 10-49; the remaining 5% is one medium-sized enterprise with a staff headcount between 50 and 250.

For this cluster of startups:

*The most outstanding tourism clients are Accommodation Services providers, Food and Beverage Services providers, Public Administrations/Tourist Destinations, and Recreational and other Entertainment Services, for 60%, 40%, 35% and 25% of them respectively.

*As regards their clients in the tourism sector, the most extensively used technologies are IoT, Cloud Computing, and Big Data, in 35%, 30% and 20% of cases respectively.

*When facing the future, one-quarter of them does not see the tourism sector as part of their future business strategy, although a higher number of non-active startups in that sector at the present is considering targeting it in the years to come.

Overall, when looking ahead, most of the respondents (55.1%) consider the tourism sector a target within their business strategies. In this second cluster, 55.6% of respondents were their CEOs/Managing Directors (when they occupy a functional position, the marketing/commercial area has also been the predominant). 77.8% of these startups are microenterprises with fewer than 10 employees; 18.5% corresponds to small companies counting with a number of employees between 10-49; the remaining percentage is one medium-sized enterprise with a staff headcount between 50 and 250.

Specifically:

*51.9% has already tourism clients in their portfolios.

*The following types of tourist company/organization are considered as their main potential clients: Accommodation Services providers, Food and Beverage Services providers, Public Administrations/Tourist Destinations, and Recreational and other Entertainment Services, for 77.8%, 55.6%, 51.9% and 40.7% of them respectively.

*And the following technologies are viewed as the main opportunities for providing services to the tourism industry: IoT, Big Data, Artificial Intelligence and Machine Learning, and Cloud Computing, in 48.1%, 44.4%, 29.6% and 25.9% of cases respectively. Among other technologies not listed in the questionnaire, the Blockchain, although at a much lower level, is worth a mention bearing in mind the references received.

Practical implications: Focusing on the startups related to the circular economy, the profile of our population (and sample) fits the typology of circular startups established by Henry, Bauwens, Hekkert and Kirchherr (2020), with five archetypes: design-based cluster, adopting circular innovations mostly in the pre-market phase through source material minimization product design or production process efficiency; waste-based cluster, seeking to extract value from unexploited external waste streams; platform-based cluster, pursuing sharing/trading business models built around B2B, B2C or C2C marketplaces; service-based cluster, embedding products in service-systems without customer ownership of the physical good; and nature-based cluster, lowering the input of non-renewable natural capital and increasing the



investment in renewable natural processes. Examples of all of them have been found in this study.

Additionally, our findings show that their appetite for the tourism industry (mainly accommodation and food & beverages companies, together with public administrations) seems to be rising, given particular attention to certain technologies (such as Internet of Things, Big Data and Artificial Intelligence & Machine Learning) in line with the trend towards digitization and automation processes. Nevertheless, for those that are most closely linked to technological development and tourism, the preliminary conclusion is that the use of the most innovative technologies is at an early stage, still focused, with some exceptions, on mobile apps and e-commerce solutions. The potential for growth in the implementation of technologies 4.0, therefore, remains very large.

In terms of its use for making real the desired advance towards a more and more circular tourism, the reduction of food waste has emerged as the most focused objective so far. Business models based on the product-as-a-service concept (pay-as-you-go or rental) are also spreading in the tourism sector, with the idea of facilitating travellers' journeys while promoting the reuse or second life of products that do not need to be purchased or brought to the destination.

Originality/value: How tourism companies can practically apply these technologies to achieve specific circular economy objectives remains a research question to be explored, with a marked lack of empirical evidence at the level of, for example, their impact on business models (Vargas-Sánchez, 2020). This work is aimed to contribute to bridging this gap in the intersection between industry 4.0, circular economy, and tourism, an area still under-researched in the literature and where knowing more about it is important for both academics and practitioners to contribute more effectively in favour of a tourism economy characterized by its environmentally friendly character.

Type of paper: Empirical research

Keywords: Industry 4.0, Circular Economy, Tourism, Start-ups, Spain

Appendix

Table 1: Main area of activity

(in alphabetical order)	Frequency	Percentage
Consulting	22	10.9
Distribution and logistics	2	1.0
Financing	1	0.5
Industrial services	4	2.0
Manufacturing	65	32.3
Online store	18	9.0
Other activities	24	11.9
Retail	9	4.5
Technology development	55	27.4
Training	1	0.5
Total	201	100.0

Source: own elaboration.

Table 2: Value chain

(in alphabetical order)	Frequency	Percentage
Building and construction	10	5.0
Electronics and ICTs	27	13.4
Others	82	40.8
Packaging	25	12.4
Plastics	20	10.0
Textile	17	8.5
Vehicles and batteries	1	0.5
Water, food and nutrients	19	9.4
Total	201	100.0

Source: own elaboration.

Table 3: Main area of activity vs Value chain

Main area of activity (in alphabetical order)	Value chain								Total
	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	
Consulting	0	1	0	3	18	0	0	0	22
Distribution and logistics	0	0	1	0	1	0	0	0	2
Financing	0	0	0	0	1	0	0	0	1
Industrial services	0	0	1	0	0	3	0	0	4
Manufacturing	7	6	7	13	17	7	8	0	65
Online store	2	1	1	0	8	0	6	0	18
Other activities	3	1	1	1	12	6	0	0	24
Retail	0	0	1	1	4	0	3	0	9
Technology development	7	1	15	7	20	4	0	1	55
Training	0	0	0	0	1	0	0	0	1
Total	19	10	27	25	82	20	17	1	201

Notes: (A) Water, food and nutrients. (B) Building and construction. (C) Electronics and ICTs. (D) Packaging. (E) Others. (F) Plastics. (G) Textile. (H) Vehicles and batteries.

Source: own elaboration.

Table 4: Value chain vs Stage in the value chain

Stage in the value chain (in alphabetical order)	Value chain								Total
	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	
Consumption and the general public	11	0	9	8	20	2	6	1	57
Eco-design, new materials and manufacturing	3	7	7	9	27	6	5	0	64
Recycling and second life	5	3	11	8	35	12	6	0	80
Total	19	10	27	25	82	20	17	1	201

Notes: (A) Water, food and nutrients. (B) Building and construction. (C) Electronics and ICTs. (D) Packaging. (E) Others. (F) Plastics. (G) Textile. (H) Vehicles and batteries.

Source: own elaboration.

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