

This is an Open Access document downloaded from ORCA, Cardiff University's institutional repository: <https://orca.cardiff.ac.uk/id/eprint/156437/>

This is the author's version of a work that was submitted to / accepted for publication.

Citation for final published version:

Bowen, Robert , Dowell, David and Morris, Wyn 2024. Hospitality SMEs and the circular economy: Strategies and practice post-Covid. *British Food Journal* 126 (1) , pp. 80-97. 10.1108/BFJ-10-2022-0932

Publishers page: <https://doi.org/10.1108/BFJ-10-2022-0932>

Please note:

Changes made as a result of publishing processes such as copy-editing, formatting and page numbers may not be reflected in this version. For the definitive version of this publication, please refer to the published source. You are advised to consult the publisher's version if you wish to cite this paper.

This version is being made available in accordance with publisher policies. See <http://orca.cf.ac.uk/policies.html> for usage policies. Copyright and moral rights for publications made available in ORCA are retained by the copyright holders.



Hospitality SMEs and the Circular Economy: Strategies and Practice Post-Covid

Robert Bowen, Cardiff University, BowenR16@cardiff.ac.uk

David Dowell, University of St Andrews, djd9@st-andrews.ac.uk

Wyn Morris, Aberystwyth University, dmm@aber.ac.uk

Abstract

Purpose: This research evaluates specific circular economy issues in relation to the hospitality sector. This is investigated in the aftermath of the Covid-19 pandemic, considering the impact that the experiences of UK hospitality SMEs had on their circular economy activities. Viewed through a resource bricolage lens, for some this was a consequence of the challenges of the pandemic, while others were proactive in pursuing circular economy strategies.

Design/methodology/approach: A sequential mixed methods research design is established based on a pragmatic worldview. The first phase analyses secondary data from the Business Insights and Conditions Survey (BICS) to evaluate circular economy aspects on hospitality businesses in the context of the Covid-19 pandemic. Phase 2 collects and analyses qualitative semi-structured interview data from directors of hospitality SMEs to investigate the experiences of businesses in this research context.

Findings: Results point to a desire for hospitality SMEs to engage in circular economy activities, especially as a means of achieving financial efficiency, however this is sometimes constrained by increased costs. Resource bricolage theory underlines potential advantages for SMEs to engage with the local community to support circular economy activities and bring mutual benefits.

Originality: This research contributes to the under-researched topic of circular economy issues in hospitality SMEs. The focus on SMEs is significant as small businesses are more resource-constrained than larger businesses. The context of the post-Covid period is also notable due to changing attitudes towards circular economy aspects from the experiences of the pandemic.

Keywords: Hospitality, Circular economy, Covid-19, Sustainability

1. Introduction

With an increasing global population, there is a greater need to produce food more efficiently (Fróna et al., 2019), climate change issues relating to food security and a threat to whole food systems (Wheeler & von Braun, 2013) and recent impacts from the Covid-19 pandemic have also left an impression on the hospitality sector. All three apply pressure to supply chains (Aday and Aday, 2020), and access to staff (Ramos et al., 2020; Venkatesan, 2020). However, a notable outcome of the pandemic was an increase in innovation acceleration (Galanakis et al., 2021), as businesses of all sizes had to adapt to the changing times. The circular economy is considered a possible solution to mitigate problems, such as the global demand for resources or climate changes (Whalen et al., 2018). The circular economy is an industrial and social evolutionary concept focussed on holistic sustainability, promoting a culture of no waste, which is based on a closed loop of material flows compared to linear ones (Julião et al, 2020).

Recent research in this context has focussed on the UN Sustainable Development Goals, including on the hospitality sector (Dube, 2021). Research also exists on strategies in reducing resource consumption, managing waste, and promoting more responsible consumer behaviour in hospitality settings (Arun et al., 2021). However, research on the circular economy and the hospitality sector remains under-developed (Sorin & Sivarajah 2021), with few publications specifically addressing this topic (e.g., Giamouri et al., 2021; Sayegh et al., 2021), given its recent emergence. There is, therefore, a need to investigate how circular economy aspects apply to the hospitality sector, especially SMEs, which tend to have access to less resources than larger businesses; and to identify strategies that businesses could apply in promoting circular economy principles into their business activities.

The aim of this research is to investigate the impact of the Covid-19 pandemic on circular economy strategies within hospitality SMEs. Firstly, this research aims to understand the effects that the pandemic had on circular economy aspects within the hospitality sector, including the attitudes and practices of hospitality SMEs towards the circular economy. Secondly, it aims to identify specific circular economy strategies that are relevant to the hospitality sector. The focus on SMEs is notable since SMEs are more resource-constrained compared to larger businesses, which could impact their ability to undertake circular economy activities. Research is conducted in the UK, where hospitality businesses were constrained by multiple lockdown periods during the Covid-19 pandemic, impacting on the ability for the business to maintain their activities.

The paper is structured firstly around a literature review of research on the circular economy and the hospitality sector, as well as research relating to Covid-19 and hospitality. This is viewed through a resource bricolage lens. Section 3 presents the methodology, and the mixed methods design of this research, section 4 documents the findings, section 5 discusses these findings in relation to the established literature on the subject, before section 6 draws conclusions from this research.

2. Literature Review

This section presents a review of relevant literature to this research. This includes academic literature on the circular economy, circular economy in hospitality, and literature relating to Covid-19 and hospitality. This section also discusses resource bricolage, the theoretical lens through which this research is viewed. Journal articles were identified through searching for

academic literature using the keywords seen in the titles of each sub-section of this literature review. The search was conducted using Scopus, the largest database of peer-reviewed literature.

2.1. Circular economy

The circular economy is an increasingly discussed concept promoting the minimisation of resource depletion, waste and emissions (Geissdoerfer et al., 2020). It originates in Bouldin's (1966) work which argued that the economy and environment should coexist in equilibrium. The circular economy challenges the established economic model of linear production and consumption, proposing a system intentionally restorative of natural and social capital, where resources and materials circulate in regenerative production and consumption cycles (Blomsma & Brennan, 2017). The circular model reconceptualises waste as a resource and replaces the end-of-life notion with renewable closed-loop life cycles, therefore circular economy promotes waste management systems through the reduce, reuse and recycle concepts (De Bernardi et al., 2022). Academic discussions on the circular economy have gained traction since 2013, with a range of definitions of the concept. A more comprehensive definition is offered by Kirchherr et al. (2017, pp. 224-225): "*A circular economy describes an economic system that is based on business models, which replaces the 'end-of-life' concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes, thus operating at the micro level (products, companies, consumers), meso level (eco-industrial parks) and macro level (city, region, nation and beyond), with the aim to accomplish sustainable development, which implies creating environmental quality, economic prosperity and social equity, to the benefit of current and future generations*". The principles of circular economy are often conceptualised by R models, prominently the 4R framework of reduce, reuse, recycle, recover, which is at the core of the EU Waste Framework Directive (European Commission, 2008). However, more recent debates have expanded this to cover more aspects, notably the 9R framework of refuse, rethink, reduce, reuse, repair, refurbish, remanufacture, repurpose, recycle, recover (Potting et al., 2017). Academic research on the circular economy from a business perspective considers the emergence of circular economy business models (Ferasso et al., 2020); supply chain management (Del Giudice et al., 2020), and food systems management (Alonso-Muñoz et al., 2022; De Bernardi et al., 2022). Considering circular economy systems relating to food, food waste offers little scope for reuse or recovery, however there is a stronger focus on reducing food waste, as food waste is biodegradable waste, and reducing food waste can have environmental, economic and social impacts. These benefits can be seen in reducing climate change impacts, reducing costs and lowering food prices, and alleviating hunger (Alonso-Muñoz et al., 2022).

2.2. Circular economy in hospitality

Research on the circular economy and the hospitality sector is limited to date. Circular economy activities in fast-moving consumer goods are largely well documented, however service-based industries, including tourism and hospitality, remain underexplored in academic research (Sorin & Sivarajah 2021). We conducted a systematic review of the literature based on the key words of 'circular economy' and 'hospitality' in the Scopus database, which yielded 40 results, of which there are 34 journal articles, 2 book chapters and 4 conference papers. The dates of publication underline that this research remains relatively recent, with the earliest publication a conference paper from 2014, with an increasing trend in the number of

publications in 2019 (6), 2020 (7), 2021 (9) and 2022 (14). A wider review by Bux and Amicarelli (2022) identified 62 publications. While their review discussed a range of circular economy issues in the literature, the three main areas of focus in the literature relate to food waste (13 articles), water consumption (9 articles) and energy consumption (7 articles).

Research on hotel operators in Scandinavia showed that there was a high level of interest in circular value creation (Sorin & Sivarajah 2021), however consumer perspective research on sustainability in the hotel sector in Portugal showed that only half of respondents were prepared to pay more if sustainable solutions were offered in their choice hotels (Julião et al, 2020). The main circular economy strategies adopted by hospitality businesses relate to the reduction, recycle, and reuse aspects (Rodríguez-Antón & Alonso-Almeida, 2019). There is a broad focus in the literature on circular economy strategies, notably food waste valorization (Giamouri et al., 2021), increase of food sustainability (Cozzio et al., 2018), plate size reduction (Kallbekken and Saelen, 2013), energy consumption reduction (Sayegh et al., 2021) and water-savings initiatives (Tirado et al., 2019). These are widely focussed on larger businesses across the hospitality sector, with a strong emphasis on tourism, therefore more research is needed on food-based hospitality SMEs.

Some research exists on farm to fork strategies, considering the consumption of local food and short food supply chains (e.g., Paciarotti and Torregiani, 2018), however, this is an area for further investigation. Operational perspectives, such as lean management use in reducing energy consumption and CO2 emissions also exists (Orynych et al., 2020). Gruia et al. (2021) state that restaurant food waste is substantial but largely avoidable, pointing to its presence at every stage of the culinary technological process. They advocate the exploration of minimising waste through recycling activities in which food could be recovered as raw materials or made a by-product, which could bring added value to restaurant logistics.

2.3. Covid and hospitality

Literature on the Covid-19 pandemic shows that the hospitality sector is highly vulnerable to economic shocks (Hu *et al.*, 2021), particularly since government regulations relating to social distancing and lockdowns caused unprecedented challenges for hospitality businesses (Gursoy & Chi, 2020). Despite this, hospitality businesses display elements of business resilience due to the seasonal nature of the sector (Ntounis *et al.*, 2022). Notable aspects on the Covid-19 and hospitality research that is relevant to circular economy issues includes business resilience (cf. Hemmington & Neill, 2022; Pillai *et al.*, 2021), technology adoption (cf. Chou *et al.*, 2021; Marinković & Lazarević, 2021), and innovation (cf. Breier *et al.*, 2021).

Despite the challenges of the pandemic, the changing economic conditions brought opportunities for hospitality businesses (Gursoy and Chi, 2020). The disruptions to international supply chains during the pandemic led to an increased focus on local supply chains, which were less impacted (Cappelli and Cini, 2020). This coincided with increased consumer support for local food producers (Palau-Saumell *et al.*, 2021). Indeed, the effects of the pandemic encouraged hospitality businesses to explore more sustainable practice, and focus on social responsibility (Elkhwesky *et al.*, 2022). The pandemic saw an increase in innovative activities by hospitality businesses, such as developing more diversified business models (Hemmington & Neill, 2022). The use of technology was important for this, including creating opportunities to sell products online (Marinković & Lazarević, 2021).

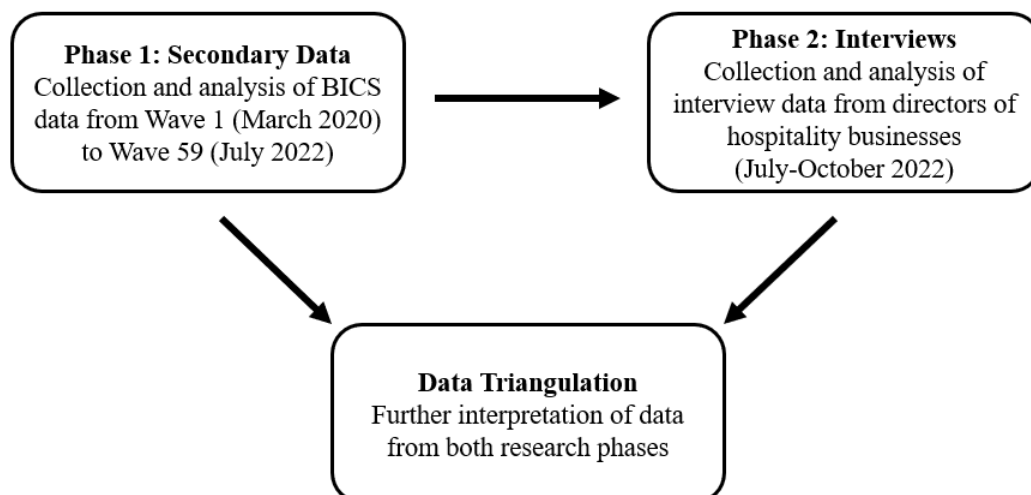
2.4. Theoretical lens

This research is underpinned by resource bricolage, which relates to resource-based view theory. The resource-based view of the firm underlines how competitive advantage can be derived from specific resources, notably those that are valuable, rare, inimitable, and non-substitutable (Barney, 1991). Resource bricolage, originating in the work of Levi-Strauss (1966, p. 17) points to the action of making do with ‘whatever is at hand’, and the leveraging of resources that are available. This is significant in the context of SMEs, given the resource constraints that are acknowledged among SMEs, which limits the opportunities that could be derived through resource bricolage activities. While research bricolage has been discussed in relation to resilience during the Covid-19 pandemic (Kuckertz *et al.*, 2020), this theoretical lens remains under-explored in circular economy research (see Wu *et al.*, 2021). Within Entrepreneurship research, bricolage theory explores how entrepreneurship emerges in resource-poor areas through leveraging under-utilised resources to create something new (Baker and Nelson, 2005). In this context, we explore how resource bricolage principles could enable hospitality businesses to develop strategies for circular economy activities.

3. Methodology

With the research aims outlined in section 1, the design of this research is based on the authors’ pragmatic worldview on applying the ‘what works’ principle (Creswell & Plano Clark, 2011), namely in establishing a research design that matches the nature of the research. Here a sequential mixed methods design is chosen with the aim of achieving a deeper understanding of circular economy issues in the hospitality industry in the post-pandemic era in the UK. The research design is presented in Figure 1, indicating that the research was conducted in two independent sequential phases before data from both phases was triangulated for further interpretation. Phase 1 (section 3.1.) represents the collection and analysis of secondary data, whereas phase 2 (section 3.2.) represents the collection and analysis of interview data. The UK was chosen as the research setting as little research has been conducted on UK hospitality businesses in relation to the Covid-19 pandemic, with the exception of Ntounis *et al.*, (2022) and Tajvidi and Tajvidi (2021). Furthermore, UK hospitality businesses were impacted by multiple periods of lockdown and prolonged social distance measures, which constrained the businesses from maintaining their activities.

Figure 1: Research Design



3.1. Phase 1: Secondary Data

The first phase undertakes a quantitative analysis of Business Insights and Conditions Survey (BICS) data. BICS is a fortnightly voluntary survey published by the ONS providing weighted estimates about financial performance, workforce, prices, trade, and business resilience (ONS, 2022). Data is gathered from the start of the pandemic (Wave 1) in March 2020 until the end of UK Covid restrictions in summer 2022 (Wave 59). Wave 59 contains data from 38,146 businesses across all industries, of which 3,829 are in the hospitality sector. The first phase aims to identify sector-specific aspects relating to circular economy issues on the hospitality sector across the Covid-19 pandemic, analysing descriptive data across waves 1-59 of BICS.

3.2. Phase 2: Interviews

The second phase includes qualitative analysis of semi-structured interviews with directors of hospitality SMEs in the UK, with questions focussed on the impact of Covid-19 on the business, the resilience of the business, and circular economy activities that the business is involved in. Questions focussed on how businesses were active in undertaking circular economy activities, as well as the opportunities and challenges that they experienced in undertaking these activities. SMEs were chosen over larger hospitality businesses, since SMEs are acknowledged as being more resource-constrained, and circular economy research on hospitality SMEs is especially sparse. Interviews were conducted in person between July and October 2022 and lasted between 45-60 minutes. Maximum variation sampling used in order to ensure that interviews represented different types of hospitality businesses, varying in size, experience, location and business type. A profile of the interview respondents is provided in Table 6. Applying data saturation, a total of six in-depth interviews were conducted. Interviews were recorded and transcribed verbatim, before a process of first and second cycle coding (Miles et al., 2014) was undertaken as part of a thematic analysis process (Braun & Clarke, 2006). This process was conducted manually, with data coding occurring using comments boxes in the Microsoft Word document for each interview, before codes were transferred to Microsoft Excel for the remainder of the thematic analysis process. Following the completion of both research phases, data was triangulated for further investigation, in which interview data was compared with the secondary data.

4. Findings

This section presents the findings from the data gathered through secondary research, from the BICS survey data, and the interviews conducted with hospitality business directors. Data is presented thematically

4.1 Secondary data

Four areas of data were observed in the BICS surveys that relate to the topic of this research. This includes the impact of Covid on the hospitality industry in the UK, climate change, net zero, and innovation.

The impact of Covid was significant on hospitality businesses in the UK. Table 1 shows turnover of hospitality and all-sector businesses compared to expected levels for the time of year across various waves of the BICS survey. The table shows that hospitality businesses were impacted throughout the Covid pandemic, with decreased levels of turnover evident across various waves, and largely higher levels of decrease compared to businesses across all sectors.

Wave 7 (1 June 2020 to 14 June 2020) showed that 36.6% of hospitality business saw a decrease in turnover of 20-50% compared to 19.1% for all sectors. Similar differences in this value were observed in waves 12 and 20, however a less negative picture was apparent in wave 43 (18 October 2021 to 14 November 2021) with slightly higher percentages of increases in turnover for hospitality businesses compared to all sectors. A more varied picture is apparent for wave 53 (7 March 2022 to 3 April 2022), in which hospitality businesses saw higher percentages in turnover increased by up to 20%, but also higher percentages across all decrease in turnover categories compared to all businesses. This underlines the uncertainty that hospitality businesses faced throughout the Covid-19 pandemic.

Table 1: Business turnover compared to expected levels for the time of year

Wave	Industry/Size Band	Turnover has increased by more than 50%	Turnover has increased between 20% and 50%	Turnover has increased by up to 20%	Turnover unaffected	Turnover has decreased by up to 20%	Turnover has decreased between 20% and 50%	Turnover has decreased by more than 50%
7	Hospitality	1.1%	1.2%	6.4%	17.4%	13.3%	36.6%	23.8%
7	All businesses	1.3%	1.7%	3.5%	29.9%	14.4%	19.1%	24.4%
12	Hospitality	n/a	1.0%	1.5%	38.8%	15.4%	36.0%	5.0%
12	All businesses	n/a	1.3%	5.3%	42.6%	15.1%	16.5%	10.5%
20	Hospitality	n/a	2.6%	n/a	13.3%	13.8%	26.2%	35.4%
20	All businesses	n/a	1.9%	2.5%	43.0%	12.8%	15.6%	13.3%
43	Hospitality	n/a	2.9%	7.9%	35.5%	28.7%	6.7%	3.1%
43	All businesses	n/a	1.5%	4.7%	51.1%	13.5%	9.6%	5.3%
53	Hospitality	0.0%	n/a	9.4%	34.8%	20.9%	15.4%	7.8%
53	All businesses	n/a	2.7%	5.0%	54.0%	12.5%	8.6%	4.6%

Data from BICS Wave 53 (7 March 2022 to 3 April 2022)

Data from the surveys also point to high levels of capital expenditure by hospitality businesses, with 78% of hospitality businesses stating that this was due to the pandemic in Wave 48 (27 December 2021 to 9 January 2022). Hospitality businesses have also experienced supply chain issues, with 55.7% of hospitality business pointing to paying higher prices compared to 53.4% across all sectors (Wave 22). A further issue of note is business confidence, with 52.5% of hospitality businesses being highly confident, compared to 75.1% for all sectors.

Secondly, data relating to climate change is displayed in Table 2. The operators in the sector are aware of climate change's potential effect on them, 10.7%, compared to 4.4% for all business had carried out an impact assessment on demand for their goods and services. Additionally, 42% of the hospitality sector had not undertaken analysis of potential climate change impacts, compared to 50.1% of all businesses. In the hospitality sector, 8.5% had a climate change strategy, 1.4% had a net zero plan, which compares to 12.6% and 6.2% for all business sectors. And with respect to bricolage, 1% of the hospitality sector had a climate strategy which included suppliers.

Factors that prevent businesses from reducing their carbon footprint, indicate that 27.4% of hospitality businesses found implementing change to be too costly for the business, compared to 17.9% for all businesses. Another notable difference for the hospitality sector was a lack of expertise to implement change, expressed by 8.7% of hospitality businesses, compared to 3.3% across all businesses surveyed. Furthermore, 12.4% of hospitality businesses were unsure of how to measure emission outputs, compared to 10.5% across all sectors, however, fewer hospitality businesses stated that action is not being prevented. Overall, the findings outline a lack of engagement and expertise in hospitality businesses from dealing with climate change.

Table 2: Factors preventing businesses from reducing the carbon emissions

Industry/Size Band	Implementing change is too costly for the business	Implementing change is too costly for the customer	Lack of expertise to assess different options for change	Lack of expertise to implement any changes	Payback on implementation takes too long	Unsure of how to measure emission output	Action is not being prevented
Hospitality	27.4%	3.3%	6.5%	8.7%	4.1%	12.4%	17.4%
All Businesses	17.9%	2.9%	4.4%	3.3%	4.9%	10.5%	32.2%

Data adapted from BICS Wave 41 (4 October 2021 to 17 October 2021)

Net zero data was also captured in BICS data. Table 3 outlines data relating to actions taken to reduce businesses carbon emissions across various waves of the survey. Data shows that hospitality businesses are less likely than businesses from all sectors to take no action to reduce emissions. Indeed, over the period of the Covid-19 pandemic, the percentage of no action for hospitality businesses declined across the various waves, until wave 45, where this level increased. Table 3 highlights that businesses engage in different actions to reduce carbon emissions, however, hospitality businesses are most likely to install smart meters, with levels of installing charging points also higher than that for all businesses. However, they are less likely than all sector businesses to electrify their vehicle fleet. These tendencies imply that hospitality businesses engage in activities that they have the capabilities to do, underlining elements of resource bricolage in undertaking activities that make use of available resources.

Table 3: Actions taken to reduce your businesses carbon emissions

Wave	Industry/Size Band	Electrifying your vehicle fleet	Installing a smart meter	Installing charging points	Installing your own renewable electricity or heating	Introducing a cycle to work scheme	No actions have been taken to reduce emissions
27	Hospitality	1.5%	13.9%	4.1%	3.4%	n/a	39.2%
27	All businesses	3.4%	10.6%	2.8%	2.4%	2.9%	57.7%
28	Hospitality	2.5%	13.8%	4.3%	2.3%	1.8%	30.4%
28	All businesses	3.5%	10.9%	2.5%	1.9%	3.0%	46.3%
33	Hospitality	3.0%	15.5%	3.7%	1.8%	3.2%	23.7%
33	All businesses	3.6%	11.6%	2.6%	1.9%	3.1%	46.4%
41	Hospitality	3.0%	15.5%	5.1%	1.9%	n/a	17.1%

41	All businesses	4.6%	9.2%	3.8%	2.2%	2.9%	22.3%
45	Hospitality	3.2%	10.1%	5.5%	n/a	n/a	34.8%
45	All businesses	6.1%	9.2%	3.7%	2.4%	2.8%	43.5%

Data adapted from BICS Wave 45 (29 November to 12 December 2021)

The fourth notable theme within the BICS data is innovation. Table 4 illustrates how businesses' innovation levels have changed since the beginning of the pandemic in March 2020. Data across waves 9, 38 and 56 show varying levels of innovation in the hospitality industry throughout the pandemic. Levels of innovation increased from 10.6% in wave 9 (29 June - 12 July) to 16.7% in wave 38 (23 August - 5 September 2021) but decreased to 8.3% in wave 56. These levels were lower than for all businesses, except for wave 38, implying that, to some extent, hospitality businesses sought higher levels of innovation through the initial period of the pandemic. This is further apparent in the 'less innovation' levels, which decreased from 10.2% in wave 9 to 2.6% in wave 38 and 2.8% in wave 56. Despite this, the highest levels shown in Table 4 are for the not applicable category, implying that innovation is not needed.

Table 4: How the business' innovation has changed since March 2020

Wave	Industry/Size Band	There has been more innovation	Innovation has not changed	There has been less innovation	Not sure	Not applicable
9	Hospitality	10.6%	28.4%	10.2%	11.6%	39.3%
9	All Industries	14.3%	29.4%	4.7%	9.7%	41.8%
38	Hospitality	16.7%	15.6%	2.6%	12.8%	52.3%
38	All Businesses	15.0%	22.8%	2.2%	14.2%	45.7%
56	Hospitality	8.3%	25.8%	2.8%	16.4%	46.7%
56	All businesses	11.0%	28.3%	2.7%	11.7%	46.3%

Data from BICS Waves 9, 38, 56

Data from Wave 38 (23 August - 5 September 2021) in Table 5 shows areas of increased innovation since March 2020. Hospitality businesses have engaged less in adopting digital technologies (11.5% compared with 28.4%) and investment in innovation activities (1.4% for hospitality, 7.9% for all sectors). The most significant category for hospitality is introducing new products and services, which could indicate the impact of lockdown measures in forcing hospitality businesses to seek new activities to maintain the business.

Table 5: Types of innovation adopted since March 2020

Industry/Size Band	Adoption of digital technologies	Changes in management practices	Improvement of existing products and services	Improvements in methods of logistics, delivery or distribution	Introduction of new products and services	Investment in innovation activities
Hospitality	11.5%	19.6%	17.1%	10.3%	26.2%	1.4%
All Businesses	28.4%	19.0%	22.0%	10.8%	19.4%	7.9%

Data from BICS Wave 38 (23 August to 5 September 2021)

4.2. Interview Data

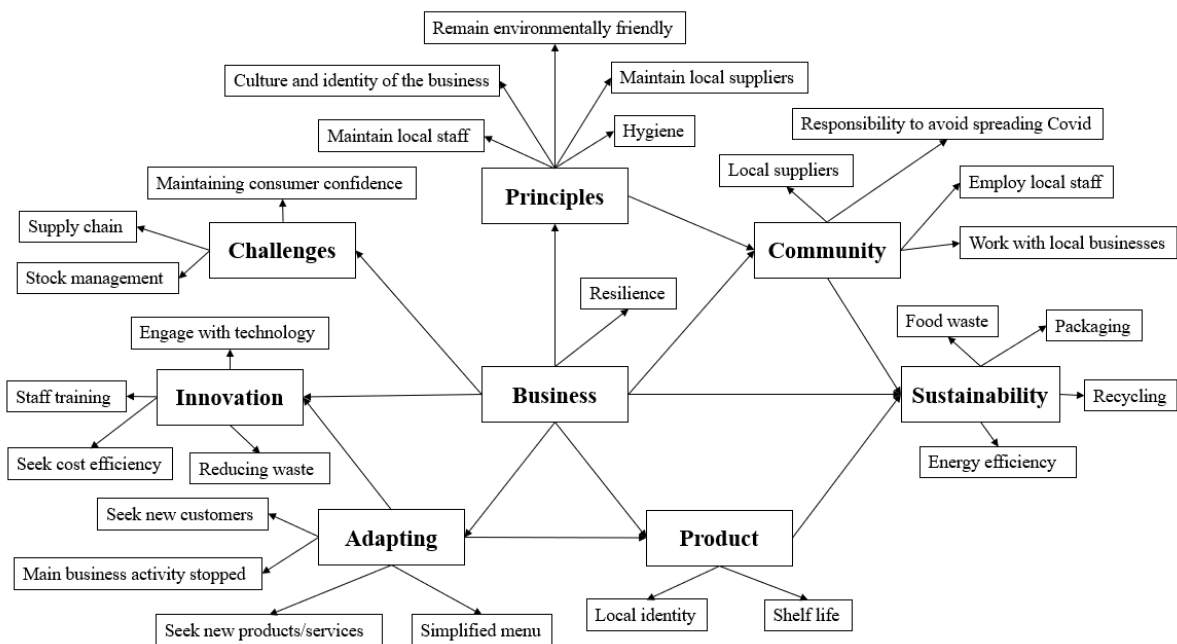
This section presents the findings of interviews with directors of hospitality businesses. A profile of interview respondents is outlined in Table 6.

Table 6: Profile of interview respondents

Respondent	Location	Years of operation	Employees	Type
R1	Rural	4	2	Cake business
R2	Urban	5	6-10	Restaurant
R3	Urban	10+	5	Takeaway
R4	Urban	10	18-20	Cafe and takeaway
R5	Urban	15+	8	Pub
R6	Rural	4	10-15	Hotel, bar and restaurant

The thematic analysis process yielded 27 unique codes, which led to 8 themes, namely the business, community, sustainability, product, adapting, innovation, challenges and principles. The codes, themes and the relationships between these themes are outlined in the thematic map in Figure 2. Each theme is discussed below.

Figure 2: Thematic map of interview data



The business is the central aspect from interview data. This relates to the local community, the principles of the business, challenges faced from the Covid-19 pandemic, innovation, adapting to changing times, the product, and sustainability. A notable focus for the business that has emerged from the pandemic is business resilience, and how the business and the hospitality sector could deal with similar challenges: *“There's been a lot of shocks to the businesses and hospitality, but the future plan then is to maybe build the business resilience”* (R6). Some businesses felt more resilient than others, depending on their situation: *“I did feel that we were well supported, and I did feel that the business was in a good place to be able to ride out the storm”* (R5). For R2, there is concern for the impacts of the pandemic on the resilience of the local community: *“I am really concerned about, not just the hospitality industry, but even what the high streets and everything will look like”*.

Indeed, community was another theme apparent in the interview data. Figure 2 points to codes relating to working with local businesses, employing local staff, working with local suppliers, and having a responsibility to avoid spreading Covid. For the latter, R2 spoke of being aware of local opinion towards remaining open during the Covid period, pointing to *“people's concerns about the spread of Covid, not that we were targeted, but we could see some businesses were potentially being targeted on social media about being irresponsible to be open. So, we took the decision then to close the main restaurant..., it was really a fine balance of trying to keep the business going early on due to its new nature, but also being aware of our responsibilities as employers in the community as well”*. For R1, engaging with the local community was a way in which the business was able to survive during the pandemic, as a way of replacing lost business: *“I knew the owners of the children's centre...and they were talking about opening a cafe within the children's centre, so they approached me about making cakes for the café”*.

Maintaining and managing supplies was one of the aspects of the challenges theme, as well as stock management and maintaining consumer confidence. Managing supplies was especially difficult for R2, whose ethos was for locally sourced food, given the impact of the pandemic on their suppliers: *“Because we were trying to source as much as possible locally, or at least Welsh, that became a problem as some of our suppliers either mothballed the business or ceased business, but we still managed to find alternatives”*. As a food business, managing stock levels of perishable goods became challenging due to the lack of certainty during the pandemic, especially due to Covid-19 regulations: *“Normally we try and keep all the stocks as far as possible so that we don't run out of stuff. But then at the time it was bare bones, so I basically used a lot of the finance to restock everything back to full and then to keep it there”* (R3).

The shelf life was one aspect of the product theme, as outlined in Figure 2, as well as the local identity. Several respondents spoke of the challenges of managing food products with specific shelf lives, which meant that businesses had to take more care about buying and storing products: *“A lot of the things we have are perishable, obviously the potatoes, the fat, once it has been used, anything that you have defrosted, pies, cheese, anything that's open, that all had to go. The fish wasn't too much of an issue because that comes in frozen, and we defrost it as we need it”* (R3).

The need to adapt was a notable theme from the interview data. This specifically relates to adapting due to the main business activity being stopped following Covid regulations, the need to seek new products or services, the need to seek new suppliers, and having a simplified menu. The introduction of Covid regulations including lockdown measures and social distancing meant that hospitality businesses were unable to maintain their habitual pre-Covid activities. This meant that the business either had to close, or was forced to adapt activities, such as by offering deliveries or a takeaway service only. For R4, this meant signing up to delivery apps: *“Now we've signed up to Just Eat and Deliveroo, so we've got these sorts of systems in place now”*. For R1, this meant proactively seeking new customers: *“I lost my kind of base business, really, which was the cafe. But I scouted out another cafe locally, which remained open through the pandemic”*. Adapting also meant that some businesses had to simplify their offering due to the challenges of managing resources: *“We used to do toasties and jacket potatoes and things, but we've actually taken that off because it's not worth having the extra member of staff in”* (R4).

Within the innovation theme, four codes were evident, notably engaging with technology, staff training, reducing waste, and seeking cost efficiencies. The use of technology was discussed in different ways, including using delivery apps (R4), online booking systems (R2, R6), and electronic till systems (R4), all of which were aimed at making processes easier for the business. R4 used the Covid period to invest in new equipment aimed at bringing cost and waste efficiencies to the business: *“I bought my new fish and chip range, a sustainable range. It has triple filtration systems, things like that, so rather than changing oil pans every day, now we can go up to 10 days. There's so much less wastage, the filters are keeping the oil clean. So that was a big thing. It saves me money, and it's also very good as well”*. Some respondents also used the period to invest in staff training (R1, R2, R6) with the aim of improving efficiencies: *“Process innovation occurred with improved training of staff, we also then really looked to reduce wastage, and a lot of that was down to maybe providing too big portions and customers leaving stuff behind, and we also looked at unnecessary wasteful activities within the restaurant and how we could improve. We also looked at our suppliers and the costs”* (R2).

Some of the innovation activities discussed above represent moves towards sustainability for the hospitality business. Further codes relating to sustainability, outlined in Figure 2, point to packaging, recycling, food waste, and energy efficiency. All businesses spoke of a focus on sustainability, for some this involved *“standardised things”* (R5) like recycling. For businesses that had introduced takeaway activities during Covid, this involved a focus on recycling packaging (R1, R2, R4): *“we try to promote reducing our waste, really limiting, or even getting rid of all the use of plastic. We quickly shifted when we went to takeaways to using compostable materials. You know, it made a difference for us personally, in terms of our customers, probably not”* (R2). Indeed, R2 noted that *“consumers are still very much price conscious, and I think the current cost of living has really pushed that sustainability agenda to one side”*. For R5, more support is needed in helping the business to be more sustainable: *“I would like to have a little bit more guidance from authorities in what is possible and what's not possible. We feel kind of left out on that really”*. Furthermore, R3 outlined issues relating to costs in being sustainable: *“Well, for me, the whole waste thing, it's all to do with saving money for the shop because that makes sense. That sounds a bit self-centred. We did use recyclable and recycled packaging before, but then they got more expensive than the non-recyclable ones, which I just found a bit...you know, it's not pointless, but for a big corporation they can absorb the costs. We kind of have to go with the prices set. We don't have any way to negotiate, so we've just got to basically survive. We make savings wherever they are”*.

Finally, many businesses from the interviews possessed strong principles. Figure 2 shows this theme contains codes relating to the culture and identity of the business, hygiene, maintaining local suppliers, local staff and being environmentally friendly. Several of these issues have been discussed in relation to other themes above, such as an interest in maintaining local suppliers and staff, as was the case for R2, as this was part of their company culture and identity of having Welsh products, and Welsh-speaking staff. For R1, hygiene was a significant aspect: *“I always had really high standards, anyway, but cleanliness to be honest, you know, clearing down and looking at everything that you do”*. A notable aspect is the aim to be environmentally friendly, with all businesses aiming to act sustainably, however, R2 pointed to the challenges of being sustainable, or maintaining the principles of the company when facing financial pressures: *“the consumers are still very much price conscious, and I think the current cost of living has really pushed that sustainability agenda to one side. And these were things that we*

tried to embed in our business really, locally sourced produce, working with the suppliers, supporting local companies and local communities and the local employment force, being environmentally friendly, sustainability, but at the end of the day, you're always judged on what is on the plate, and how much the consumer pays for it".

5. Discussion

Findings from this research align with previous research that there is a high level of interest in circular economy activities within hospitality SMEs (Sorin & Sivarajah, 2021). Quantitative data from the BICS survey shows that hospitality businesses engaged in innovation and made efforts to reduce emissions. This was further supported by interview data, which showed businesses' desire to operate sustainably and used the Covid-19 pandemic period to undertake innovation practice (Breier *et al.*, 2021; Hemmington & Neill, 2022), such as staff training and upgrading equipment, or engaging with technology adoption (cf. Chou *et al.*, 2021; Marinković & Lazarević, 2021). This related to making cost savings within the company as a response to the challenges of the pandemic with the aim of increasing the resilience of the business (Ntounis *et al.*, 2022). Indeed, hospitality businesses are seen to be prone to economic shocks (Hu *et al.*, 2021), particularly in light of government regulations during the Covid-19 pandemic, which brought significant challenges to hospitality businesses (Gursoy & Chi, 2020).

The desire for hospitality SMEs to act responsibly was manifested in various forms of sustainable practice, aligning with previous research on circular economy practice in the hospitality sector (Geissdoerfer *et al.*, 2020). This includes reducing portion sizes (Kallbekken & Saelen, 2013), as expressed by R2; energy consumption reduction (Sayegh *et al.*, 2021), as discussed by R1, R3, and R4; increasing food sustainability (Cozzio *et al.*, 2018), as expressed by R4 and R5; and reducing food waste (Giamouri *et al.*, 2021), which was an issue for all interview respondents. These issues echo the main findings of Bux and Amicarelli (2022) as the main circular economy issues relating to the hospitality sector.

These activities relate mostly to the reduce, reuse and recycle elements of the R models discussed in the circular economy literature (European Commission, 2008; Potting *et al.*, 2017). This is largely due to the nature of hospitality businesses and the products and services that they possess. Interview respondents spoke of the challenges of dealing with perishable foods and storing foods appropriately given the shelf life. Packaging was another aspect for hospitality businesses, with interview respondents discussing issues relating to reducing the use of plastic and using recyclable materials when diversifying into takeaway activities. A notable aspect for businesses, especially due to the recent cost-of-living crisis is the expense to invest in more environmentally friendly materials, with some respondents acknowledging that there would be little cost benefit for them to use these materials. Some also questioned whether consumers would appreciate the benefits of using recyclable packaging, echoing findings of Julião *et al.* (2020) that not all consumers would be prepared to pay more for more socially responsible practice. Another area for reduction was in aiming to reduce energy consumption and acting more socially responsible towards climate change effects. This was apparent from the quantitative data and interview responses, as interviewees expressed a desire to be more environmentally friendly, but also reducing costs for the business.

Findings point to circular economy activities of hospitality SMEs being dependent on resources. Limited financial resources at a time of economic difficulty meant that some businesses decided against using more environmentally friendly materials in their packaging,

as the cost benefit was perceived to be too low for the business, as well as a perception that few consumers would value this. The Covid-19 pandemic had the effect of making businesses rethink their activities, with some interview respondents reducing staff, rethinking their menu and their business focus as a result of the challenging economic time. This was apparent through diversifying the offering of the business, but a notable aspect for some interview respondents was engaging with the community. R1 spoke of the need to proactively seek new customers which had been lost due to Covid regulations and turning to the community for support was a solution to this, finding new customers locally, as well as new suppliers. Supply issues were notable during the pandemic, but respondents, such as R2, spoke of being less impacted than others due to their localised supply chain. Indeed, the local community proved to be a valuable resource in promoting resilience among some hospitality SMEs especially in promoting localised supply chains.

Considering resource bricolage theory, respondents highlighted their engagement in making use of the resources at hand as a means of overcoming the challenges of the pandemic and building business resilience. This was done through rethinking their business activities by channelling their resources to offer diversified products and services, using social media as a means of promoting their business, or engaging closely with the local community to seek mutual benefits through supporting each other. This is especially notable in resource-poor areas in using under-utilised resources to create something new (Baker and Nelson, 2005). This focus can enable hospitality SMEs to further develop circular economy strategies. By focussing on their specific resources and rethinking how they can be leverage more effectively, hospitality SMEs can develop greater business resilience particularly during times of economic shocks. This is further enhanced through developing a strong localised network in which resources can be shared and more control over supply chains, which could serve to reduce the impact that economic shocks have on the supply chain, by not being reliant on national or international suppliers, and bringing benefits to the local economy through ensuring that businesses support each other. By developing a more diversified business model in this way, hospitality businesses could support sustainable activities, including reducing energy consumption, food waste and lessen their impact on the environment.

6. Conclusion

Findings from this research underline a desire for hospitality SMEs to engage in circular economy activities, notably in reducing, reusing and recycling with the aim of supporting sustainability. The Covid-19 pandemic encouraged and forced some businesses to seek this, as a means of developing business resilience. Indeed, resource bricolage activities underline the ability of SMEs to develop resilience through leveraging under-utilised resources at their disposal. However, for some, challenging economic conditions mean that circular economy activities, such as using environmentally friendly materials in packaging, becomes less of a priority due to increased costs. Outcomes from the research point to managerial, policy and research implications. From a managerial perspective, this research has outlined strategies for hospitality SMEs to engage with local businesses and the local community to share resources, engage in localised supply chains and provide support towards developing business resilience. Indeed, resource bricolage theory reinforces the advantages of leveraging resources through the local community in supporting circular economy activities among hospitality SMEs. Policy implications of this research outline the need to facilitate opportunities for circular economy activities to occur. This includes policy promoting reducing, reusing and recycling activities,

an emphasis on sustainability, and encouragement towards innovation. Support during the Covid-19 pandemic, such as through the furlough scheme or grants, was invaluable in ensuring the resilience and survival of many hospitality SMEs, therefore policy should aim to encourage and facilitate resilient business models within hospitality SMEs. Research implications include the need for more research on circular economy activities among SMEs, and their ability to undertake circular economy activities from a resource bricolage perspective.

This research contributes to limited existing research on circular economy activities in the hospitality sector, notably within SMEs, where research is sparse. The findings have shed light on the ability for hospitality SMEs to achieve circular economy aims and act in a socially responsible manner, both to the environment and the local community. As an under-researched area, this merits further research, particularly closer research on hospitality SMEs, which face more resource constraints. Limitations are acknowledged in the smaller sample size within this research; however, the mixed methods design ensures that depth is achieved in understanding the main issues of this topic, therefore future research can build on these initial findings.

References

- Aday, S. and Aday, M.S. (2020), "Impact of COVID-19 on the food supply chain", *Food Quality and Safety*, Vol. 4 No. 4, pp. 167–180.
- Alonso-Munoz, S., García-Muiña, F. E., Medina-Salgado, M. S., & González-Sánchez, R. (2022). Towards circular economy practices in food waste management: a retrospective overview and a research agenda. *British Food Journal*, 124(13), 478-500.
- Arun, T.M., Kaur, P., Bresciani, S., & Dhir, A. (2021). "What drives the adoption and consumption of green hotel products and services? A systematic literature review of past achievement and future promises". *Business Strategy and the Environment*, 2021, 1– 19.
- Baker, T., & Nelson, R. E. (2005). "Creating something from nothing: Resource construction through entrepreneurial bricolage". *Administrative science quarterly*, Vol. 50 No. 3, pp. 329-366.
- Barney, J.B. (1991), "Firm Resources and Sustained Competitive Advantage", *Journal of Management*, Vol. 17 No. 1, pp. 99–120.
- Blomsma, F., & Brennan, G. (2017). "The emergence of circular economy: a new framing around prolonging resource productivity". *Journal of Industrial Ecology*, Vol. 21 No. 3, pp. 603-614.
- Boulding, E. K. (1966). *The economics of the coming spaceship earth*. In H. Jarett (Ed.), "Environmental quality in a growing economy" (pp. 3–14). Earthscan.
- Braun, V., & Clarke, V. (2006). "Using thematic analysis in psychology". *Qualitative Research in Psychology*, Vol. 3 No. 2, pp. 77–101.
- Breier, M., Kallmuenzer, A., Clauss, T., Gast, J., Kraus, S. and Tiberius, V. (2021), "The role of business model innovation in the hospitality industry during the COVID-19 crisis", *International Journal of Hospitality Management*, Elsevier, Vol. 92, p. 102723.

- Bux, C., & Amicarelli, V. (2022). "Circular economy and sustainable strategies in the hospitality industry: Current trends and empirical implications". *Tourism and Hospitality Research*, 14673584221119581.
- Cappelli, A. and Cini, E. (2020), "Will the COVID-19 pandemic make us reconsider the relevance of short food supply chains and local productions?", *Trends in Food Science & Technology*, Vol. 99, pp. 566–567.
- Chou, S.-F., Liu, C.-H.S. and Lin, J.-Y. (2021), "Critical criteria for enhancing consumption intention in restaurants during COVID-19", *British Food Journal*, Vol. 124 No. 10, pp. 3094-3115.
- Cozzio, C. (2019). "The concept of sustainability in hotel industry: current dominant orientations and future issues". *International Journal of Sustainable Development*, Vol. 22 No. 1-2, pp. 61-87.
- Creswell, J. W., & Plano Clark, V. L. (2011). *Designing and Conducting Mixed Methods Research*. SAGE Publications.
- De Bernardi, P., Bertello, A. and Forliano, C. (2022), "Circularity of food systems: a review and research agenda", *British Food Journal*, Vol. ahead-of-print No. ahead-of-print.
- Del Giudice, M., Chierici, R., Mazzucchelli, A. and Fiano, F. (2021), "Supply chain management in the era of circular economy: the moderating effect of big data", Vol. 32 No. 2, pp. 337-356.
- Dube, K. (2021). "Sustainable Development Goals Localisation in the Hospitality Sector in Botswana and Zimbabwe". *Sustainability*, Vol. 13 No. 15, p. 8457.
- Elkhwesky, Z., Salem, I.E., Varmus, M. and Ramkissoo, H. (2022), "Sustainable practices in hospitality pre and amid COVID-19 pandemic: Looking back for moving forward post-COVID-19", *Sustainable Development*, Vol. 30 No. 5, pp. 1426-1448
- European Commission (2008). "Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on Waste and Repealing Certain Directives". Available at: {<https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32008L0098&from=EN>} [Accessed 24/10/2222]
- Ferasso, M., Beliaeva, T., Kraus, S., Clauss, T., & Ribeiro-Soriano, D. (2020). "Circular economy business models: The state of research and avenues ahead". *Business Strategy and the Environment*, 29(8), 3006-3024.
- Fróna, D., Szenderák, J. and Harangi-Rakos, M. (2019). "The Challenge of Feeding the World". *Sustainability*, Vol. 11 No. 20, p. 5816.
- Galanakis, C.M., Rizou, M., Aldawoud, T.M.S., Ucak, I. and Rowan, N.J. (2021), "Innovations and technology disruptions in the food sector within the COVID-19 pandemic and post-lockdown era", *Trends in Food Science & Technology*, Vol. 110, pp. 193–200.
- Geissdoerfer, M., Pieroni, M. P., Pigosso, D. C., & Soufani, K. (2020). "Circular business models: A review". *Journal of Cleaner Production*, Vol. 277, 123741.

- Giamouri, E., Pappas, A.C., Papadomichelakis, G., Tsiplakou, E., Sotirakoglou, K., Markakis, N., Galliou, F., Manios, T., Zentek, J., Lasaridi, K. and Fegeros, K. (2021). "The food for feed concept. Performance of broilers fed hotel food residues". *British Poultry Science*, Vol. 62 No. 3, pp. 452-458.
- Gruia, R., Florescu, G. I., Gaceu, L., Oprea, O. B., & Țane, N. (2021). "Reducing Environmental Risk by Applying a Polyvalent Model of Waste Management in the Restaurant Industry". *Sustainability*, Vol. 13 No. 11, 5852.
- Gursoy, D. and Chi, C.G. (2020), "Effects of COVID-19 pandemic on hospitality industry: review of the current situations and a research agenda", *Journal of Hospitality Marketing & Management*, Taylor & Francis, Vol. 29 No. 5, pp. 527–529.
- Hemmington, N. and Neill, L. (2022), "Hospitality business longevity under COVID-19: The impact of COVID-19 on New Zealand's hospitality industry", *Tourism and Hospitality Research*, SAGE Publications Sage UK: London, England, Vol. 22 No. 1, pp. 102–114.
- Hu, F., Teichert, T., Deng, S., Liu, Y. and Zhou, G. (2021), "Dealing with pandemics: An investigation of the effects of COVID-19 on customers' evaluations of hospitality services", *Tourism Management*, Elsevier, Vol. 85, p. 104320.
- Julião, J., Gaspar, M., Tjahjono, B., & Rocha, S. (2018). "Exploring circular economy in the hospitality industry". In *International Conference on Innovation, Engineering and Entrepreneurship* (pp. 953-960). Springer, Cham.
- Kallbekken, S., & Sælen, H. (2013). "'Nudging' hotel guests to reduce food waste as a win-win environmental measure". *Economics Letters*, Vol. 119 No. 3, pp. 325-327.
- Kirchherr, J., Reike, D., & Hekkert, M. (2017). "Conceptualizing the circular economy: An analysis of 114 definitions". *Resources, conservation and recycling*, Vol. 127, pp. 221-232.
- Kuckertz, A., Brändle, L., Gaudig, A., Hinderer, S., Morales Reyes, C.A., Prochotta, A., Steinbrink, K.M., *et al.* (2020), "Startups in times of crisis – A rapid response to the COVID-19 pandemic", *Journal of Business Venturing Insights*, Vol. 13, p. e00169.
- Levi-Strauss, C. (1966), *The Savage Mind*, University of Chicago Press.
- Marinković, V. and Lazarević, J. (2021), "Eating habits and consumer food shopping behaviour during COVID-19 virus pandemic: insights from Serbia", *British Food Journal*, Vol. 123 No. 12, pp. 3970–3987.
- Miles, M. B., Huberman, A. M., & Saldana, J. (2014). *Qualitative Data Analysis: A Methods Sourcebook*. SAGE Publications.
- Ntounis, N., Parker, C., Skinner, H., Steadman, C. and Warnaby, G. (2022), "Tourism and Hospitality industry resilience during the Covid-19 pandemic: Evidence from England", *Current Issues in Tourism*, Taylor & Francis, Vol. 25 No. 1, pp. 46–59.
- ONS (2022), "Business insights and impact on the UK economy" Available at: {<https://www.ons.gov.uk/economy/economicoutputandproductivity/output/datasets/businessinsightsandimpactontheukeconomy>} [Accessed 02/10/2022]

- Orynych, O., & Tucki, K. (2020). "Technology Management Leading to a Smart System Solution Assuring a Decrease of Energy Consumption in Recreational Facilities". *Energies*, Vol. 13 No. 13, 3425.
- Paciarotti, C., & Torregiani, F. (2018). "Short food supply chain between micro/small farms and restaurants: An exploratory study in the Marche region". *British Food Journal*, Vol. 120 No. 8, pp. 1722-1734.
- Palau-Saumell, R., Matute, J., Derqui, B. and Meyer, J.-H. (2021), "The impact of the perceived risk of COVID-19 on consumers' attitude and behavior toward locally produced food", *British Food Journal*, Vol. 123 No. 13, pp. 281–301.
- Pillai, S.G., Haldorai, K., Seo, W.S. and Kim, W.G. (2021), "COVID-19 and hospitality 5.0: Redefining hospitality operations", *International Journal of Hospitality Management*, Vol. 94, p. 102869.
- Potting, J., Hekkert, M. P., Worrell, E., & Hanemaaijer, A. (2017). "Circular economy: measuring innovation in the product chain". *Planbureau voor de Leefomgeving*, (2544).
- Ramos, A.K., Lowe, A.E., Herstein, J.J., Schwedhelm, S., Dineen, K.K., & Lowe, J.J. (2020). "Invisible No More: The Impact of COVID-19 on Essential Food Production Workers", *Journal of Agromedicine*, Taylor & Francis, Vol. 25 No. 4, pp. 378–382.
- Rodríguez-Antón, J. M., & Alonso-Almeida, M. D. M. (2019). "The circular economy strategy in hospitality: A multicase approach". *Sustainability*, Vol. 11 No. 20, 5665.
- Sayegh, M. A., Ludwińska, A., Rajski, K., & Dudkiewicz, E. (2021). "Environmental and energy saving potential from greywater in hotels". *Science of The Total Environment*, Vol. 761, 143220.
- Sorin, F., & Sivarajah, U. (2021). "Exploring Circular economy in the hospitality industry: empirical evidence from Scandinavian hotel operators". *Scandinavian Journal of Hospitality and Tourism*, Vol. 21 No. 3, pp. 265-285.
- Tajvidi, R. and Tajvidi, M. (2021), "The growth of cyber entrepreneurship in the food industry: virtual community engagement in the COVID-19 era", *British Food Journal*, Vol. 123 No. 10, pp. 3309–3325.
- Tirado, D., Nilsson, W., Deyà-Tortella, B., & García, C. (2019). « Implementation of water-saving measures in hotels in Mallorca". *Sustainability*, Vol. 11 No. 23, 6880.
- Venkatesan, P. (2020), "The changing demographics of COVID-19", *The Lancet Respiratory Medicine*, Elsevier, Vol. 8 No. 12, p. e95.
- Whalen, K. A. (2019). "Three circular business models that extend product value and their contribution to resource efficiency". *Journal of cleaner production*, Vol. 226, pp. 1128-1137.
- Wheeler, T. and von Braun, J. (2013), "Climate Change Impacts on Global Food Security", *Science*, American Association for the Advancement of Science, Vol. 341 No. 6145, pp. 508–513.

Wu, C. Y., Hu, M. C., & Ni, F. C. (2021). « Supporting a circular economy: Insights from Taiwan's plastic waste sector and lessons for developing countries”. *Sustainable production and consumption*, Vol. 26, pp. 228-238.