

Circular Economy in Hospitality Food and Beverage: Barriers and Drivers

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Abstract

The food and beverage sector within hospitality generates substantial waste streams, contributing to both financial losses and environmental degradation. This study examines how hotels and restaurants adopt circular economy principles in their F&B operations, identifying the principal barriers and drivers that influence adoption decisions and measuring the performance outcomes of circular practices. Using a multiple case study approach involving 15 hospitality properties across Europe (United Kingdom, Spain, Netherlands) and Asia (Thailand, Singapore, Japan), data were collected through semi-structured interviews with 38 operations managers, document analysis of waste audit records, and on-site observation of kitchen and procurement processes. Findings indicate that circular economy adoption in F&B operations yields measurable reductions in food waste (averaging 42 percent among adopters), meaningful cost savings (8–15 percent of F&B operating budgets), and improved carbon performance. However, adoption is constrained by high initial investment requirements, fragmented supply chains, staff knowledge gaps, and inconsistent regulatory frameworks. The study proposes an integrative barriers-drivers framework and offers practical recommendations for hospitality operators seeking to transition toward circular F&B systems.

Keywords: - Circular Economy, Food Waste, Hospitality, Food And Beverage, Sustainability, Waste Management

I. INTRODUCTION

The global hospitality industry produces an estimated 79 million tonnes of food waste annually, representing between 3 and 12 percent of total food purchased by hotels and restaurants (WRAP, 2020). This waste carries environmental costs through greenhouse gas emissions from decomposition, economic costs through lost procurement expenditure, and reputational costs as consumers increasingly scrutinise the sustainability practices of food service providers (Papargyropoulou et al., 2014). Despite growing recognition of these impacts, the hospitality sector has been slower to embrace circular economy principles than manufacturing and retail industries (Merli et al., 2018).

The circular economy, as conceptualised by the Ellen MacArthur Foundation (2013), seeks to eliminate waste and keep materials in productive use through strategies of reducing, reusing, recycling, and regenerating. Applied to hospitality F&B operations, this translates into practices such as menu engineering to minimise overproduction, surplus food redistribution to community organisations, composting of organic waste, sourcing from local regenerative agriculture, and replacing single-use packaging with reusable alternatives (Principato et al., 2019).

While individual circular practices have been studied in isolation food waste measurement (Pirani & Arafat, 2016), composting programmes (Martin-Rios et al., 2018), local sourcing initiatives (Gössling et al., 2011) there is a notable absence of research examining the full spectrum of circular economy adoption within hospitality F&B operations. Furthermore, existing studies tend to focus on either barriers or drivers in isolation, without examining how these forces interact to shape adoption trajectories across different organisational and regulatory contexts.

This study addresses this gap through a comparative case study of 15 hospitality properties in Europe and Asia, examining how they adopt circular economy practices in their F&B operations, what barriers and drivers shape adoption, and what performance outcomes result from circular transitions. By studying properties at different stages of circular economy adoption across diverse regulatory environments, the research captures the variability in both motivations and obstacles that shape the transition process.

II. LITERATURE REVIEW

2.1. Circular Economy Principles and Hospitality

The circular economy concept has evolved from early industrial ecology thinking (Frosch & Gallopoulos, 1989) into a broad framework for economic transformation that challenges the linear 'take-make-dispose' model. The Ellen MacArthur Foundation's (2013) butterfly diagram distinguishes between technical and biological nutrient cycles, a distinction particularly relevant to hospitality where food waste falls within the biological cycle while packaging and equipment belong to the technical cycle. Kirchherr et al. (2017) catalogued 114 definitions of the circular economy, noting that the concept is frequently reduced to recycling and waste management in practice, despite its broader ambitions of systemic redesign.

Within hospitality, circular economy research has concentrated on two areas: food waste reduction and sustainable procurement. Food waste studies have established that hotels generate between 0.4 and 1.2 kg of food waste per guest per night, with buffet-style dining producing significantly more waste than à la carte service (Pirani & Arafat, 2016). Betz et al. (2015) found that plate waste accounted for 34 percent of total food waste in Swiss hotel restaurants, while kitchen preparation waste constituted 45 percent, suggesting that both guest behaviour and kitchen processes require attention.

2.2. Food Waste Drivers in Hospitality

The causes of food waste in hospitality settings are well documented but difficult to address in practice. Papargyropoulou et al. (2014) proposed a food waste hierarchy prioritising prevention over redistribution, redistribution over recycling, and recycling over disposal a framework that aligns with circular economy principles. However, Filimonau and De Coteau (2019) observed that most hotel food waste initiatives focus on the lower tiers of this hierarchy (composting and biogas) rather than prevention, partly because prevention requires changes to procurement, menu design, and guest service that touch on core hospitality operations.

Buffet services represent a particularly intractable source of food waste. Guest expectations for visual abundance and variety conflict directly with waste minimisation, and revenue management practices that incentivise food and beverage capture through all-inclusive packages exacerbate the problem (Juvan et al., 2018). Attempts to reduce buffet waste through smaller serving vessels, cooking-to-order stations, and demand prediction algorithms have shown promise in individual properties but have not been widely scaled (Dhir et al., 2020).

2.3. Barriers and Drivers of Circular Adoption

Previous research has identified several categories of barriers to circular economy adoption in hospitality. Financial barriers include the capital costs of composting equipment, grease trap systems, and reusable packaging infrastructure (Martin-Rios et al., 2018). Organisational barriers encompass staff resistance to new sorting protocols, high turnover rates that undermine training investments, and siloed management structures that separate F&B procurement from waste management (Styles et al., 2016). Supply chain barriers arise from the fragmentation of food supply networks, limited availability of certified sustainable suppliers, and contractual arrangements that impede waste redistribution (Mondéjar-Jiménez et al., 2016).

On the driver side, regulatory pressure particularly the European Union's Farm to Fork Strategy and national food waste reduction targets has created compliance incentives for larger hotel chains (Principato et al., 2019). Consumer demand for sustainable dining experiences has emerged as a market driver, with Neff et al. (2015) reporting that 72 percent of diners in their US sample expressed concern about restaurant food waste. Cost savings from waste reduction provide a financial driver that can strengthen the business case for circular transitions, particularly for properties where food costs represent 30–40 percent of F&B revenue (Pirani & Arafat, 2016).

III. METHODOLOGY

A multiple case study design (Yin, 2018) was employed to examine circular economy adoption across 15 hospitality properties. Properties were selected through purposive sampling to ensure variation across three dimensions: geography (Europe vs. Asia), property type (hotels vs. standalone restaurants), and circular economy maturity (early-stage, transitioning, and advanced adopters). The European sample comprised five properties in the United Kingdom, three in Spain, and two in the Netherlands. The Asian sample included two properties in Thailand, two in Singapore, and one in Japan.

Data collection involved three methods. First, semi-structured interviews were conducted with 38 participants, including F&B directors, executive chefs, procurement managers, and sustainability coordinators. Interviews followed a topic guide covering current circular practices, perceived barriers and drivers, performance measurement, and future plans. Each interview lasted 40–70 minutes and was recorded with consent. Second, documentary evidence was gathered, including waste audit reports, procurement records, sustainability certifications, and internal training materials. Third, on-site observation was conducted at 10 of the 15 properties, focusing on kitchen waste sorting, food preparation processes, and packaging practices.

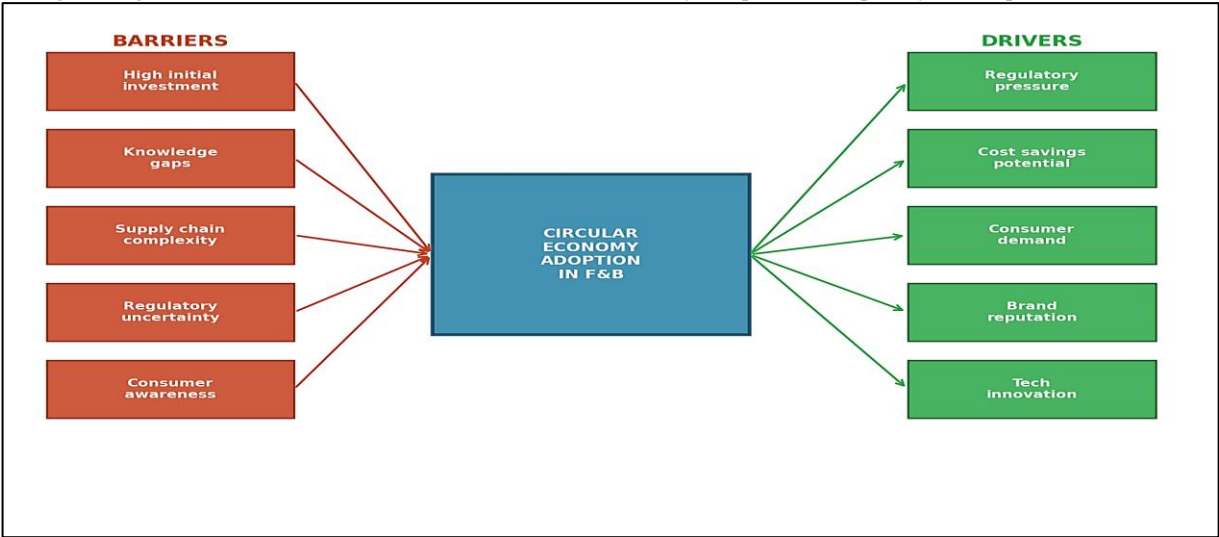
Data analysis followed Braun and Clarke's (2006) thematic analysis protocol. Initial coding was conducted inductively, generating 187 first-order codes that were subsequently organised into 23 second-order themes and six aggregate dimensions. A cross-case analysis compared patterns across the three maturity levels and two geographic regions. To enhance validity, member checking was conducted by sharing preliminary findings with 12 interviewees, whose feedback was incorporated into the final analysis.

IV. RESULTS AND ANALYSIS

4.1. Barriers-Drivers Framework

Fig 1 presents the integrative barriers-drivers framework that emerged from the thematic analysis. Five barrier categories and five driver categories were identified, each exerting differential influence depending on property size, location, and circular maturity stage.

Fig 1. Integrative Barriers-Drivers Framework for Circular Economy Adoption in Hospitality F&B Operations



4.2. Performance Outcomes

A clear performance differential emerged between properties that had adopted circular economy practices and those that had not. Fig 2 compares key performance metrics across the two groups.

Fig 2: Performance Comparison Between CE-Adopting and Non-Adopting Hospitality Properties

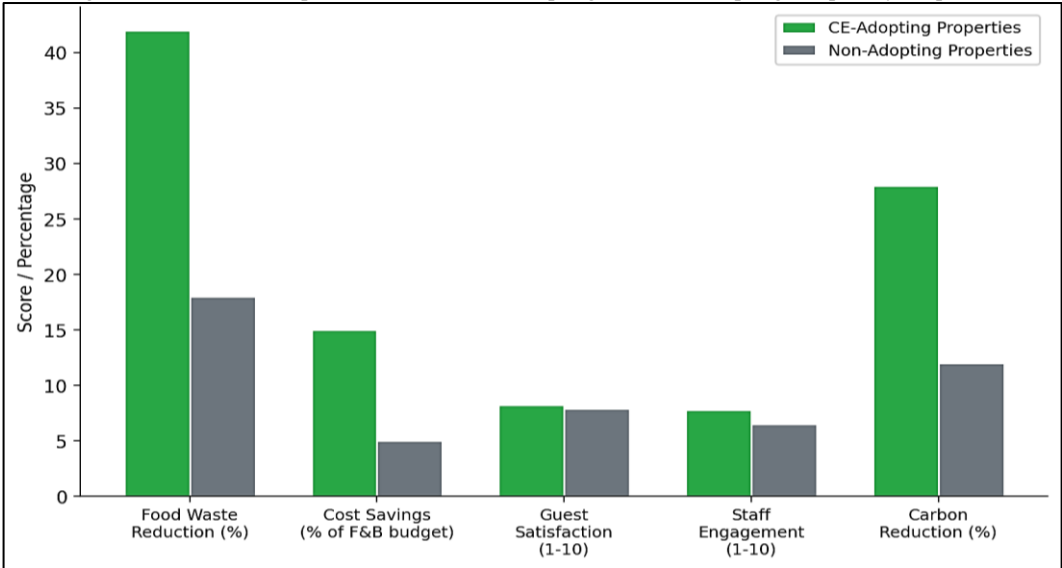


Table 1. Circular Economy Practices Adopted Across Case Study Properties

Practice Category	Europe (n=10)	Asia (n=5)	Overall Adoption
Food waste measurement & tracking	90%	80%	87%
Composting / anaerobic digestion	80%	60%	73%
Surplus food redistribution	70%	40%	60%
Menu engineering for waste reduction	60%	80%	67%
Local / regenerative sourcing	50%	60%	53%
Reusable packaging systems	40%	60%	47%
Closed-loop water recycling in kitchens	30%	40%	33%

Table 1 reveals that food waste measurement was the most widely adopted practice (87 percent), reflecting its role as a prerequisite for other interventions. Composting and anaerobic digestion were the second most common (73 percent), consistent with the literature's observation that end-of-pipe solutions are adopted before prevention measures. Menu engineering showed higher adoption in Asia (80 percent) than Europe (60 percent), a finding interviewees attributed to the greater integration of F&B planning with waste concerns in Asian culinary traditions.

Table 2. Barrier Prevalence by Circular Economy Maturity Stage

Barrier	Early Stage (n=5)	Transitioning (n=5)	Advanced (n=5)
High initial investment	Very High	Moderate	Low
Staff knowledge gaps	Very High	High	Low
Supply chain complexity	High	High	Moderate
Regulatory uncertainty	Moderate	Moderate	Low
Consumer awareness deficit	High	Moderate	Low

Table 2 shows that barrier prevalence diminished with circular maturity, though supply chain complexity remained a persistent challenge even among advanced adopters. Early-stage properties identified investment costs and staff knowledge as their primary obstacles, while advanced adopters reported that these had been substantially overcome through phased investment approaches and embedding circular thinking into standard training programmes.

V. DISCUSSION

The findings of this study advance understanding of circular economy adoption in hospitality F&B operations in several ways. First, the integrative barriers-drivers framework developed here moves beyond the single-category analyses that have characterised previous research. The interaction between barriers and drivers is not simply additive; rather, certain drivers can directly neutralise specific barriers. For instance, regulatory pressure (EU Farm to Fork targets) provided the impetus for properties to overcome the investment barrier by enabling operators to justify capital expenditure to ownership as compliance costs rather than voluntary sustainability spending.

Second, the geographic comparison revealed unexpected patterns. Asian properties showed higher adoption of prevention-oriented practices (menu engineering, portion calibration) while European properties led in waste processing technologies (composting, anaerobic digestion). This divergence appears to reflect different cultural orientations toward food waste. Interviewees in Thailand and Japan described food waste as a source of personal and professional shame among chefs, creating strong normative pressure for prevention. European interviewees framed waste more as a management problem to be solved through technology and systems, consistent with Mourad's (2016) observation that Western food waste discourse emphasises technical solutions over behavioural change.

Third, the maturity-stage analysis suggests that circular economy adoption follows a predictable trajectory. Properties typically begin with measurement and end-of-pipe solutions (composting), progress to redistribution and procurement changes, and eventually arrive at systemic redesign including menu engineering and closed-loop systems. This trajectory mirrors the food waste hierarchy proposed by Papargyropoulou et al. (2014), though the transition between stages is neither automatic nor linear. Several properties reported periods of stagnation when the 'low-hanging fruit' of waste measurement and composting had been captured but the harder work of supply chain restructuring and menu redesign required capabilities they had not yet developed.

The performance outcomes documented here provide a persuasive business case for circular adoption. The 42 percent average food waste reduction among adopting properties, combined with cost savings of 8–15 percent of F&B operating budgets, represents a compelling return on investment that should interest hotel operators even in the absence of environmental motivation. However, these figures come with a caveat: the most advanced circular practices (closed-loop water recycling, regenerative sourcing partnerships) require upfront investments with payback periods of 3–5 years, a timeframe that exceeds the planning horizons of many hospitality operators, particularly those operating under short-term management contracts.

VI. CONCLUSION AND IMPLICATIONS

This study examined circular economy adoption in the F&B operations of 15 hospitality properties across Europe and Asia, identifying the barriers, drivers, and performance outcomes associated with the transition from linear to circular waste management. The findings demonstrate that circular practices yield tangible financial and environmental benefits, but that adoption requires navigating a complex landscape of organisational, financial, supply chain, and regulatory challenges that vary by geography and maturity stage.

For hospitality operators, the practical implications are threefold. First, food waste measurement should be treated as the foundational step in any circular transition, as it provides the data needed to identify priority areas and track progress. Second, phased investment approaches that begin with low-cost, high-impact interventions (menu engineering, portion control) and progress to capital-intensive technologies (composting, biogas) are more likely to sustain momentum than ambitious programmes that attempt systemic change simultaneously. Third, supply chain partnerships with local producers and food redistribution organisations are necessary to close the loop beyond individual property boundaries.

For policymakers, the study suggests that regulatory clarity and consistency are among the most effective drivers of circular adoption in hospitality. Properties operating under clear food waste reduction mandates showed higher adoption rates than those facing voluntary targets, supporting the case for binding regulations that create a level playing field across the sector.

Limitations of this study include the relatively small sample size, which limits statistical generalisability, and the reliance on self-reported waste data that may be subject to measurement inconsistencies. Future research should employ longitudinal designs to track circular economy adoption trajectories over time and quantitative approaches to test the causal relationships suggested by the barriers-drivers framework.

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