

Review article

Circular economy beyond manufacturing: Exploring the challenges and opportunities for circularity in the hairdressing industry

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ABSTRACT

The emergence of the circular economy (CE) as a transformative paradigm to achieve sustainable development has predominantly centred on manufacturing, leaving a significant void in exploring its applicability to service-based industries. Understanding the challenges and opportunities for implementing CE strategies in these contexts is crucial, as service businesses differ in their operations and often face unique challenges. This study utilises the hairdressing industry as a contextual lens to investigate the multifaceted manifestations of circularity within services. We conducted a systematic literature review of both academic and grey literature to examine CE approaches, including reducing, reusing, recycling, and recovery strategies, while emphasising their interconnections with environmental quality, economic prosperity, and social equity. Our results point to a bias toward recycling strategies with little attention being given to R-strategies like reduce, reuse and recover. We highlight a critical need to broaden circularity initiatives by coordinating resource efficient practices with waste management strategies. Additionally, we reveal a web of interrelated circularity and sustainability aspects that demonstrate both synergies (mutually beneficial interactions) and trade-offs (compromises) across and between these aspects. Our findings stress the importance of taking a systems perspective when examining CE initiatives, calling for thoughtful consideration of diverse pathways to achieve sustainability alongside careful evaluation of trade-offs against potential gains. The insights gleaned from this exploration in hairdressing hold promising implications for promoting integrated and socially equitable CE strategies in diverse service-based industries.

1. Introduction

The concept of a circular economy (CE) has emerged as a pivotal paradigm shift in contemporary sustainability discussions, offering a systematic approach to counteract the detrimental effects of our current linear economic system. By rethinking the way resources are produced, consumed, and managed, the CE seeks to slow, narrow, and ultimately close resource loops (Bocken et al., 2016). The CE is often heralded as a practical and operationalisable framework with the potential to deliver substantial environmental and economic benefits through the implementation of a hierarchy of R-strategies—e.g. reduce, reuse, recycle and recover (Garcia et al., 2021; Reike et al., 2018). At the heart of this transformation is the ambition to uphold sustainable development, not only in ecological terms but also with a strong emphasis on social equity (Mies and Gold, 2021; Schröder et al., 2020). However, several scholars point out that its many and varied interpretations seldom capture all these elements in one unified, holistic definition. A notable exception is

that by Kirchherr et al. (2017) whose definition recognises a hierarchy of R-strategies, from superior resource management approaches (e.g. reducing and reusing) to lower tier waste management approaches (e.g. recycling and recovery), while acknowledging how these link to the three pillars of sustainable development.

Nevertheless, a substantial gap exists in current CE discourse: while the concept has been widely applied in manufacturing, services remain hugely underrepresented in the literature (Kirchherr and van Santen, 2019). The service sector, comprising a diverse range of industries such as healthcare, education, hospitality, and personal care, plays a pivotal role in the economy. In Europe, for example, services account for roughly 75 % of GDP and employment in the EU (European Commission, 2023). Different from manufacturing industries, service provision is generally small-scale and often involves onsite interaction with consumers, diverse resource use, and customisation, making the sector an important subject for CE scrutiny. The hospitality industry's ever-fluctuating consumption of water, energy and food or the use of

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personal protective equipment (PPE) to prevent disease transmission in healthcare, or creative services offered by hair and beauty professionals point to some of the unique characteristics of service-based industries. These examples highlight the challenge of applying our current understanding of the CE, primarily developed within manufacturing contexts, to industries that differ significantly in their operational frameworks.

This study aims to address this prominent gap in CE discourse, specifically in how circularity manifests within service-based industries, with a focus on the hairdressing industry. Because circularity encompasses more than just closing resource loops (e.g. recycling), this research also investigates the implementation of narrowing (e.g. reducing) and slowing (e.g. reusing) strategies. In addition, it assesses how these strategies align with sustainability principles across environmental, economic and social dimensions. To this end, we conduct a systematic literature review of academic and grey literature to address the following research questions: 1) What challenges and opportunities do hairdressing business activities present for circularity (i.e. by preventing or enabling reduction, reuse, recycling and recovery strategies), and 2) How do these activities contribute to or hinder sustainability (i.e. by preventing or enabling environmental quality, economic prosperity and social equity)?

Hairdressing is an intriguing case as it represents a significant and dynamic industry within the services sector, employing 1.7 million people in Europe in 2019 (Eurostat, 2020). In the UK, spending at these mostly small and medium sized establishments (SMEs) reached 4.6 billion GBP in 2020–2021 (National Hair and Beauty Federation, 2023) and in the US 64.7 billion USD (Zipdo, 2023). The available data suggest that this service industry is not only stable in defiance of others like retail and foodservice—which are almost unrecognisable from even a decade ago due the optimisation of online shopping—but that it is also growing. Even with repeated closures due to the pandemic and the cost-of-living crisis, hairdressing is thriving with over 48,000 hairdressing businesses in the UK in 2022, up 5 % from 2021 (National Hair and Beauty Federation, 2023) and nearly double that in both France (Union Nationale des Entreprises de Coiffure, 2023) and Germany (Zentralverband des Deutschen Friseur Handwerks, 2023). However, the industry's expanding landscape is not uniformly positive, with growing concerns and evidence indicating instances where hairdressing establishments and barbershops may serve as fronts for money laundering (Lambert, 2023).

The industry's enduring growth compels attention to how hairdressing and barbering professionals use and dispose of the resources they require for service provision. Like other service industries, salons and barbershops are major consumers of critical resources such as water and energy as well as other resources like plastics, metals, textiles and more. Hairdressers and barbers handle toxic, sometimes carcinogenic chemicals contained within standard products such as dyes, bleaches, and chemical relaxers. The fact that this industry requires close physical proximity with these chemicals in addition to many different people warrants concern over the wellbeing of both the professionals and their clients. From a resource perspective, the human element of hairdressing necessitates the use of specialised equipment and PPE, which, in turn, necessitates the management of these additional resources.

The unique contribution of this review is fourfold. Firstly, it brings much needed focus to services, which are often absent from CE literature (Kirchherr and van Santen, 2019). By leveraging both academic and grey literature, we gain contextualised insights into application of CE principles within the underexplored industry of hairdressing and barbering. Second, this paper examines the diverse manifestations of CE within a specific context, even in the absence of explicit references to 'circular economy' in the literature. This approach allows for a nuanced understanding of the connections between hairdressing business activities and circularity. Third, this study goes beyond the conventional environmental focus of the CE by systematically exploring social aspects of hairdressing business activities such as worker health and safety, occupational challenges, community engagement and systemic societal

impacts. Lastly, we identify the subtle interplay between pursuing circularity and wider sustainability impacts, highlighting both synergies and trade-offs between the CE and sustainability more broadly.

2. Methods

A systematic literature review is a valuable tool for exploring a new research topic due to its ability to provide an objective appraisal of existing evidence, identify gaps in knowledge, and generate new research questions (Haddaway and Macura, 2018). The systematic approach ensures transparency and minimises bias, making the review more trustworthy (Haddaway and Macura, 2018), and allows for the inclusion of all relevant findings, thereby providing a comprehensive overview of the topic (Tikito and Souissi, 2019). In line with de Jesus and Mendonça (2018), the method applied in this study uses a dual approach, by which both academic and grey literature sources are accessed and integrated. This approach aims to mitigate biases that may arise with a single-source approach (de Jesus and Mendonça, 2018, p. 77) and fosters a more comprehensive understanding of the evidence (Paez, 2017, p. 2). We also searched both academic and grey literature because of the substantial contributions of both scholars and non-academic stakeholders to the implementation and conceptualisation of the CE concept (Geissdoerfer et al., 2017; Kirchherr et al., 2017). Furthermore, drawing on these wider sources of data enables a contextualisation of CE (de Jesus et al., 2018, p. 3014) and valuable insights into current best-practice examples (Klewitz and Hansen, 2014). The following Sections 2.1 and 2.2 describe the method used for the systematic literature search and the subsequent analysis of the collected data, respectively.

2.1. Data collection

The review proceeded in six steps (see Fig. 1). Each is explained in detail. Scopus and Web of Science databases were chosen to search for academic coverage on the topic of circularity in hairdressing. Nexis and Google were chosen to search for coverage on the topic in the grey literature. The former allows for easy execution of a systematic search of news articles, while the latter is useful for exploring a wide variety of publications including news articles, government reports and the web-pages of product and service providers (all items hereafter referred to as 'articles').

Data collection took place in June (grey literature) and July (academic literature) of 2023, guided by a deliberate search strategy largely informed by the CE definition proposed by Kirchherr et al. (2017, p. 229): “an economic system that replaces the ‘end-of-life’ concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes. It operates 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, thus simultaneously creating environmental quality, economic prosperity and social equity, to the benefit of current and future generations. It is enabled by novel business models and responsible consumers.”

Given the limited discussion of CE within the context of hairdressing, especially in academic literature, our search string included terms related to hairdressing activities, circularity, as well as broader terms in our adopted CE definition to avoid overlooking relevant but indirectly related literature. Terms centring around sustainable development and the environment, for example, were included in the search string. Following Sarja et al. (2021), the search terms contained neither negative nor positive aspects of CE so as “to find impartial content on the subject” (p.4). Table 1 presents how Kirchherr's definition informed our search strategy and subsequent coding framework.

In Scopus and Web of Science, the search was made in title, abstract and keywords, while this option was not available in Nexis or Google. The search was not limited to specific journals, news outlets or

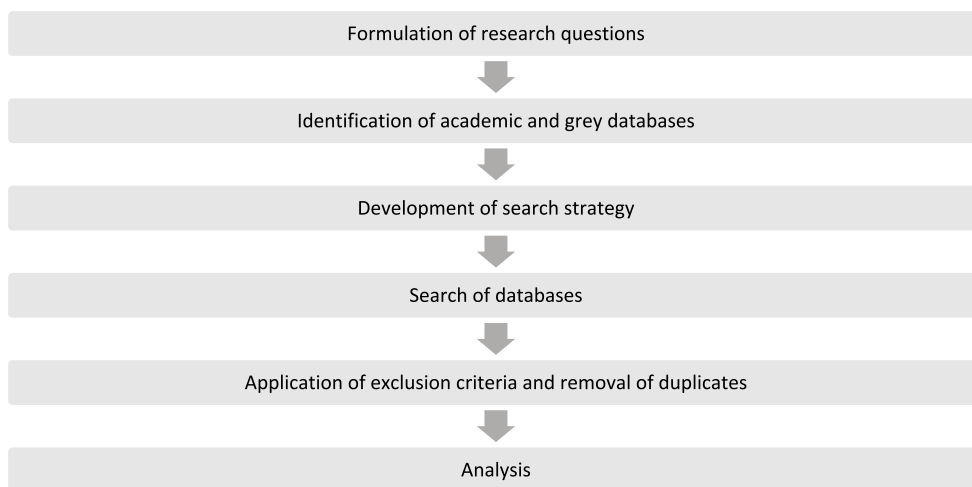


Fig. 1. Phases of the literature review process.

Table 1
Translation of Kirchherr et al.’s (2017) CE definition into search terms for the literature review.

Excerpt	Relevance to the present study	Search terms
“an economic system”	This research investigates CE as an alternative economic system.	“circular”, “econom*”
“that replaces the ‘end-of-life’ concept”	This research investigates the ‘end of life’ concept, more commonly referred to as waste.	“waste*”
“with reducing, alternatively reusing, recycling and recovering materials”	This research investigates various R-strategies including reducing, reusing, recycling and recovering of materials.	“reduc*”, “reus*”, “recycle*”, “recover*”
“in production/distribution”	This research does not investigate manufacturing but service contexts.	n/a
“and consumption processes.”	This research investigates how service businesses consume resources.	“consum*”
“It operates at the micro level (products, companies, consumers)”	Companies are the unit of analysis in this research.	“hairdress*”, “barber*”, “hair salon”
“meso level...and macro level...”	This research does not investigate meso or macro level CE.	n/a
“with the aim to accomplish sustainable development”	This research investigates how CE aligns with sustainable development.	“sustainab*”
“thus simultaneously creating environmental quality, economic prosperity and social equity, to the benefit of current and future generations.”	This research investigates the three pillars of sustainable development.	“environment*”, (“econom*”,) “social”
“It is enabled by novel business models and responsible consumers.”	This research investigates how service businesses consume resources.	(“consum*”)

geographic regions; however, it was limited to articles published in English and within the last ten years.

In the academic literature, the search generated 2161 articles from Scopus and 1137 articles from Web of Science. During the initial analysis, it was noticed that many articles had a broad focus, only minimally mentioning hairdressing. Therefore, exclusion criteria were developed for articles to include/exclude in the review (see Table 2). Articles were excluded whose focus did not reflect the present study’s research

Table 2
Inclusion and exclusion criteria for literature search.

	Inclusion	Exclusion
Source type	Academic: Journal articles, conference papers, letters Grey: News articles, government reports, official guidance, company websites	News videos
Timescale	Including and after 2013	Before 2013
Language	English only	
Focus	Articles focusing exclusively on hairdressing or barbering and at most one other industry or profession Articles referencing circularity (e.g. resource consumption, waste or activities involving reduce, reuse, recycle and/or return)	Articles with a broad focus, examining several industries or professions Articles referencing sustainability (e.g. environmental quality, economic prosperity or social equity) without also referencing circularity
Content	Grey literature sharing anecdotal examples (e.g. existing salons sharing their own practices)	Grey literature stating unsupported examples unless from government documents or official guidance

context. Articles focusing on hairdressing and at most one other industry or profession were included, but those listing hairdressing among several industries or professions were excluded.

In the grey literature, the search generated over 10,000 results in both Nexis and Google. While our examination of academic literature was comprehensive, the grey literature was not exhaustive due to database limitations and space constraints. It was noticed that some consisted of news videos and that many articles enumerated unsubstantiated examples. News videos were excluded. Grey literature sharing anecdotal examples were included, whereas unsupported examples of practices were excluded unless these were from government or other authoritative sources. For example, product company blogs listing ecotips for salons without specific references to available products and services or their own practices were excluded. Hair salon blogs stating their own efforts or achievements to become more circular or sustainable were included.

During the initial screening of titles or headlines and abstracts or summaries, it was noticed that there was sometimes no explicit focus on circularity nor circularity aspects (e.g. reducing, reusing), but that these aspects were referenced in addition to discussions around sustainability. It was decided to include articles focusing on sustainability if a link could be made to any of the four R-strategies. This approach allows for

an examination of subtler connections and influences that may not be readily apparent, thereby enabling a nuanced understanding of the interplay between circularity and sustainability aspects in hairdressing business activities.

After records were screened and duplicates were removed, 1076 academic and 184 grey accessible articles were read in full to confirm their eligibility for inclusion in the final dataset. 1258 articles were removed according to our exclusion criteria and in the end, 103 articles were included in the review. Fig. 2 presents a PRISMA diagram including preferred reporting items for systematic reviews.

2.2. Analysis

The selected 103 articles were analysed individually to identify circularity challenges and opportunities arising from hairdressing business activities using an iteratively developed coding strategy. A comprehensive assessment of these, along with the resources and value chain activities involved, required a systematic coding framework to capture all the necessary information. Initial coding dimensions were developed based on the research context (i.e. hairdressing), Kirchherr et al.'s (2017) CE definition, and literature on value chain activities. For the latter, we complemented Porter's (2004) widely adopted value chain model with insights from circular value chain models (Eisenreich et al., 2022) and service industries (Castellacci, 2008; Francis et al., 2008; Hill, 1999; Kumar, 2020; Moeller, 2010). Two coders reached agreement on which terms to code and their precise definitions (see Table 3).

While the CE is commonly acknowledged for its potential to enhance environmental quality, it is also recognised for its capacity to foster economic prosperity and social equity. In light of this, we opted to explore circularity through R-strategies but distinct from the traditional three pillars of sustainable development, in order to identify the interconnections between these dimensions as they are portrayed in the available literature. This approach allowed us to attend to instances of business practices primarily focused on, say, emissions reduction or environmental restoration (i.e. environmental aspects), which may not necessarily prioritise material reduction or waste stream recycling (i.e. circularity aspects) but that do ultimately pose challenges or opportunities for circularity, either directly or indirectly.

The coding process initially encompassed identifying both positive (opportunities) and negative (challenges) aspects. Additionally, it was observed that all business activities involved multiple circularity or

sustainability dimensions. Thus, it was decided to capture *primary* and *secondary* aspects. The terms 'primary' and 'secondary' in this context do not imply a hierarchy of importance; rather, they distinguish between the central, in-focus circularity or sustainability aspects (i.e. challenges and opportunities) and the referenced but not centrally addressed aspects (i.e. synergies and trade-offs).

3. Results and discussion

This section is divided into five sub-sections. First, we provide a brief overview of the sample. Second, we present and discuss findings related to circularity challenges in hairdressing. Third, we present and discuss findings related to opportunities. Fourth, we summarise the connections between circularity and sustainability aspects as they unfold in this industry. Fifth, we discuss key limitations of the present study and avenues for future research.

3.1. Sample overview

This search resulted in near equal input from academic (48 %) and grey (52 %) sources, offering a broad and balanced spectrum of perspectives on the CE in hairdressing. The relevance of the CE in hairdressing is reflected in the variety of information sources and in their geographical distribution. Almost half (48 %) of the articles originate from Europe, with the UK contributing significantly (55 % of European articles). Other European countries, including Denmark (10 %), Sweden (8 %), and Italy (6 %), also contribute to the discussion. Beyond Europe, the Americas (15 % of the total) and Asia (15 %) play a role in exploring the CE in hairdressing. On a country level, the UK (26 % of the total) is accompanied by the USA (12 %) and Australia (8 %). The criteria for articles to have been published in English may account for this bias.

Our sample highlights that the CE in hairdressing is a relatively recent topic (see Fig. 3), with a majority (42 %) of articles published in 2023. Only a small fraction of publications from 2023 is from academic sources, while the majority originates from grey literature. However, this can be explained as grey literature is regularly updated, often reflecting the year of access rather than publication.

3.2. Circularity challenges in hairdressing

Our analysis revealed that while the majority (74 %) of discussions

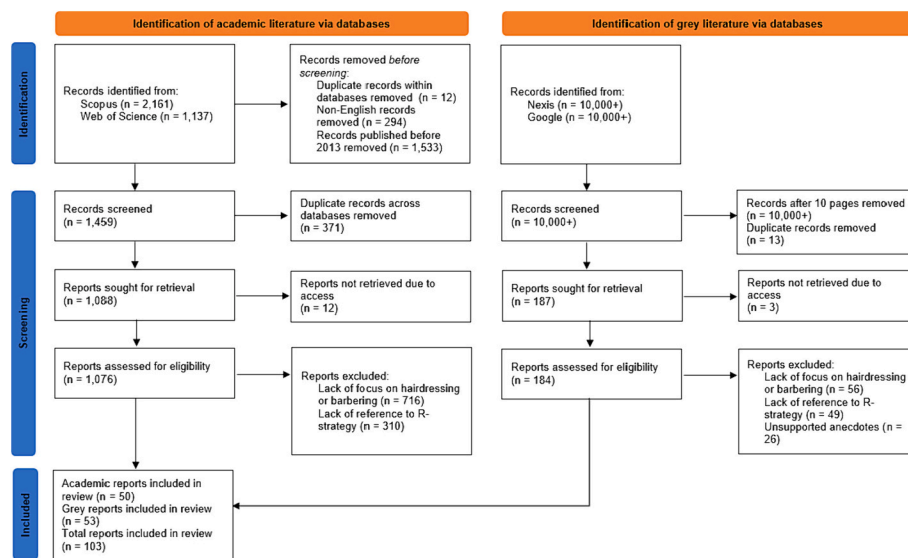


Fig. 2. PRISMA declaration for the searching and filtering of data sources. Source: Adapted from Page et al. (2021).

Table 3
Coding strategy for selected literature.

Dimensions	Value chain activities	Resources
Circularity aspects	Service provision [D]: activities directly involved in provision of services	Chemicals [D]
Reduce [D]: activities enabling (or preventing) reduction, refusing, rethinking, redesigning (including prolonging the lifespan of products), minimisation, prevention of resource use and/or preserving of natural capital	Operations [D]: activities not directly involved in provision of services, including reception, storage and stocking of materials, maintenance and cleaning	Energy [D]
Reuse [D]: activities enabling (or preventing) reusing (excluding waste), repairing or refurbishing of resources	Waste management [D]: activities like separating, storing and disposing of waste materials	Equipment [I]
Recycle [D]: activities enabling (or preventing) recycling, remanufacturing and/or reuse of waste materials	Marketing and sales [D]: activities like attracting customers and providing them with a means to purchase	Glass [D]
Recover [D]: activities enabling (or preventing) incineration of materials with energy recovery	Procurement [D]: purchasing of inputs for any primary or support activities	Hair [D]
Sustainability aspects	Human resource management [D]: staff-related activities such as recruitment, compensation or training	Metal [D]
Environmental [D]: activities enabling (or preventing) maintaining, protecting and/or restoring the environment	Firm infrastructure [D]: overhead activities like general management, finance and accounting, and legal affairs	Paper [D]
Economic [D]: activities enabling (or preventing) maintaining, protecting, transforming and/or strengthening the economy	Technology development [D]: activities to improve service provision such as basic research, media or market research, and improvements to maintenance processes	Plastic [D]
Social [D]: activities enabling (or preventing) protecting, transforming, strengthening and/or developing society, human well-being and/or jobs		PPE ^a [D]
Challenges/opportunities		Product [D]
Challenges [D]: activities (in focus) preventing or diminishing circularity or sustainability aspects		Sharps [I]
Opportunities [D]: activities (in focus) involving or enabling circularity or sustainability aspects		Towels [D]
Synergies/trade-offs		Water [D]
		WEEE ^b [D]
		Workers [I]
Synergies [I]: peripheral opportunities		
Trade-offs [I]: peripheral challenges		

Note: [D] = deductively; coding dimension was chosen already prior to starting the first round of coding, [I] = inductively; coding dimension was added during the coding process.

^a PPE stands for personal protective equipment.

^b WEEE stands for waste electrical and electronic equipment.

Source: Circularity and sustainability definitions from Kirchherr et al. (2017).

focused on opportunities, a few (26 %) oriented toward challenges. This orientation was not mirrored across both academic and grey literature: circularity and sustainability aspects were consistently framed positively in product or service pages, news articles, blogs, and the like, whereas the academic articles in our sample demonstrated a near-even distribution of problem-oriented (45 %) and solution-oriented (55 %) perspectives. Articles focusing on problems often discussed possible solutions but were coded as challenges due to their primary focus on investigating the issue rather than the resolution.

Strikingly, the majority (93 %) of challenge-oriented articles centre on social aspects, mostly exploring occupational illnesses. Hairdressing professionals are found to be at high risk for skin conditions like contact

dermatitis due to prolonged contact with chemicals, allergens and even water (Lauriola and Corazza, 2023). Consistent exposure to various chemical agents makes this group at high risk for chronic respiratory diseases like asthma (Aljohane et al., 2019). These so-called social challenges often presented counterintuitive secondary links to circularity. For example, minimal use of PPE positively influences resource efficiency (i.e. reduced resource consumption), but increases health-related risks. The remaining challenge-oriented articles concern waste, exploring topics such as salon wastewater toxicity (de Souza et al., 2020) and hair waste reprocessing difficulties (Mondal et al., 2020).

Many and varied secondary challenges surfaced. Most of the negative secondary aspects identified were economic (e.g. additional overheads, fees, or taxes), but not all of these were trade-offs (i.e. challenges associated with solutions). Numerous social challenges were reported to cause additional economic complications, such as when occupational harm to health forces hairdressers to leave their profession early causing financial strain to both the hairdresser and salon. These observations in hairdressing align with those in informal sectors correlating ill health impacts with labour productivity and healthcare-related expenditure (Sarker et al., 2016), and in healthcare itself, where occupational stress and burnout contribute to inefficiencies (Krom et al., 2020).

We found that each circularity and sustainability aspect represents a trade-off at some point across the hairdressing value chain. An innovative recycling programme imposing fees on salons is an illustrative example of a circular solution having associated economic trade-offs. Similarly, the use of PPE to protect workers from exposure to harmful chemicals illustrates a common trend in this industry where social solutions negatively influence circularity (e.g. increased resource use; Lind et al., 2015).

Most resources employed in hairdressing or barbering businesses are perceived as challenges necessitating some form of solution (Fig. 4). These materials were portrayed as costly overheads requiring careful management, as waste streams necessitating disposal, or as risks to humans and the natural world necessitating mitigation. Chemicals (e.g. volatile organic compounds emitted during flat ironing or permanent hair colouring; Louis et al., 2021) were the most frequently cited resource in the sample and consistently framed negatively due to the occupational risks they pose to practitioners. Professional products such as hair dyes and bleach emerged as a significant category, commonly viewed as challenges due to their often potentially toxic chemical composition.

Amidst these, two critical resources, water and energy, received significant attention. Both stand as indispensable components in the running of hairdressing and barbering facilities: water finds direct application in services, particularly in activities like hair washing, while energy serves to power facilities and heat water. Alongside salaries, wages and rent, utilities such as water and electricity represent substantial operational costs for these businesses, demanding meticulous oversight. Acknowledging the global scarcity of potable water and the challenges posed by climate change, it is reassuring that these critical resources are duly considered in hairdressing.

The human-centric nature of hairdressing and barbering, typical of many service industries, necessitates substantial onsite physical interactions between workers, customers, and products. Workers, treated as key resources in our circularity analysis, elicited considerable examination in the sample. Workers were identified as central to many challenges, primarily in instances where working conditions impeded their ability to perform their creative duties effectively. Intimate contact between these professionals and a diverse clientele inherently poses risks of disease transmission, a feature identified as a key challenge.

As a supplier-dominated service industry (Castellacci, 2008), reliant on a continual influx of products to be utilised for service provision, the hairdressing industry bears the responsibility for in-house use and disposal of these products and their packaging. Unlike manufacturing industries that shift the burden of use and disposal to consumers, as in goods manufacturing, this internal responsibility amplifies challenges

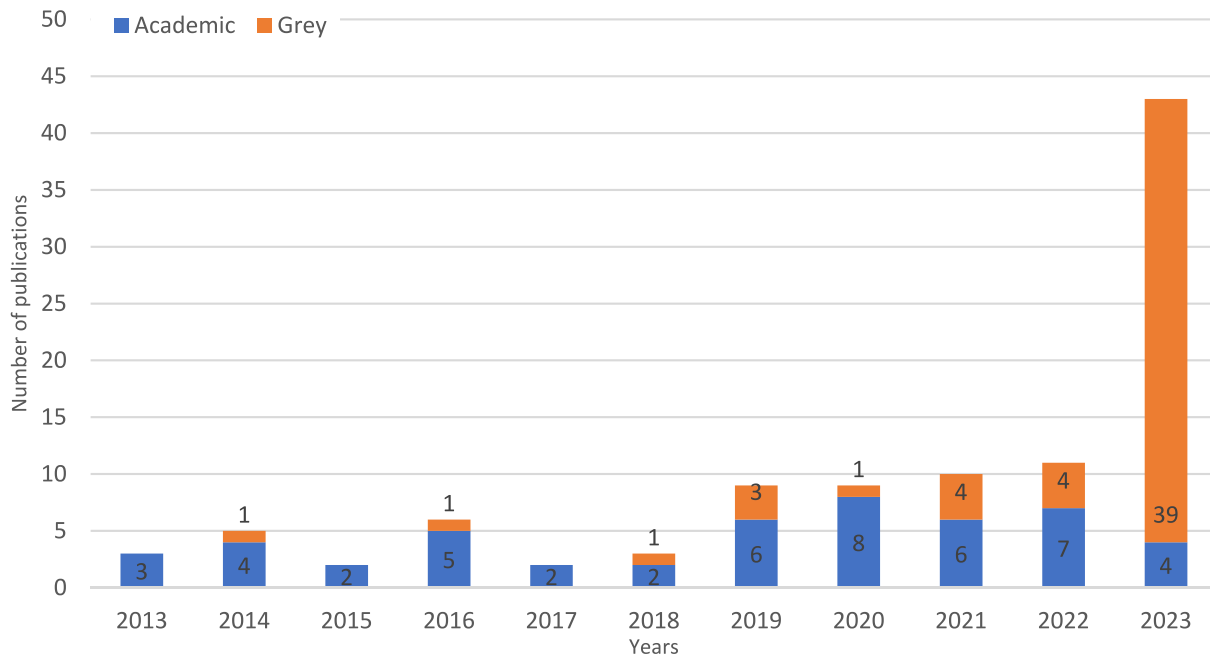


Fig. 3. Sample years of publication disaggregated into academic and grey literature.

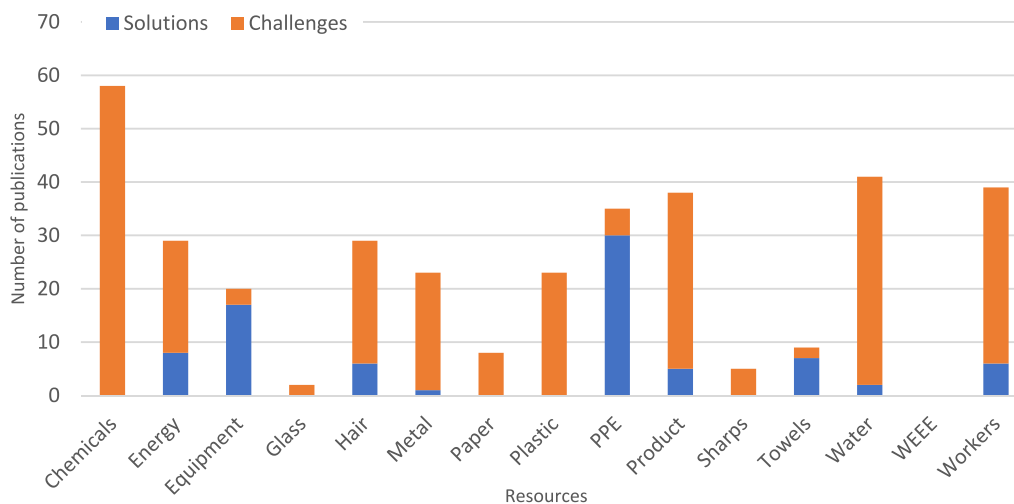


Fig. 4. Hairdressing challenge and solutions by resources.

related to waste management. This was evident in our data, where waste management activities like recycling were identified as challenges in nearly half of the articles.

3.3. Opportunities for innovative circular solutions in hairdressing

A considerable portion (46 %) of identified opportunities—activities involving or enabling circularity and sustainability—aim to address waste. These solutions encompass diverse strategies, primarily (49 %) revolving around waste management (e.g. recycling activities) and procurement choices (26 %) that enable resource recycling or reprocessing. Nearly all materials employed in hairdressing businesses are potentially recyclable, including critical resources like water (e.g. water filtration systems) or potentially toxic ones like chemicals (e.g. targeted recycling services). In addition to conventional materials such as plastics, metals, and textiles, this industry is involved in the recycling of human hair waste, employing innovative applications that transform this frequently disregarded waste stream into diverse products. These

range from reuse as wigs (Hair to Ware, 2021) to serving as compost feedstock (Waliczek et al., 2023) to functioning as a source of electrical energy (Tan and Bautista, 2018).

Our analysis found few (13 %) reported opportunities to explicitly address resource consumption. These involved human resource strategies (40 %) including training apprentices to use water efficiently or procurement strategies (40 %), such as buying water-saving shower heads. Overall, hairdressing business activities aiming to slow or narrow resource loops were much less prevalent than those focusing on closing resource loops, with very few (4 %) efforts addressing both aspects simultaneously. These findings are disheartening because, while recycling is valuable, reducing and reusing resources have a more substantial impact on environmental quality (Kirchherr et al., 2017; Reike et al., 2018). Moreover, a bias toward recycling over prioritising reduction and reuse strategies risks perpetuating unsustainable resource consumption pattern (Ma et al., 2019). The focus on waste-centric solutions over resource efficiency strategies suggests an unbalanced approach to circularity in the hairdressing industry.

During our initial analysis it became evident that all the reported business activities involved more than one circularity or sustainability aspect. Thus, we differentiated primary and secondary aspects, categorised as positive or negative. These so-called ‘synergies’ and ‘trade-offs’, respectively, provided nuanced insights into the reported opportunities. Through this lens, we found that even when resource efficiency (i.e. reduction) was not explicitly targeted, many (43 %) articles focusing on recycling reported some form of positive synergy with resource efficiency. An illustrative example of this is innovative recycling programmes adopted by salons (e.g. Green Salon Collective in the UK) sometimes prompting hairdresser behaviours like using less water. However, there are instances where synergies benefitting resource efficiency are problematic (see below).

Likewise, resource efficiency-focused solutions (e.g. activities enabling the slowing or narrowing of resource loops) were found to have positive synergies with waste management (e.g. recycling efforts co-occurring alongside resource efficiency strategies) and both were found to have synergies with the three sustainability aspects (e.g. circular strategies having additional environmental, economic and/or social benefits). Very few of these articles reported negative trade-offs, all of which were economic.

The second most common aspect being addressed in hairdressing businesses were those aiming to improve environmental quality (30 %). Distinct from circularity-focused solutions involving one or more R-strategies, these represent efforts in the business to reduce emissions (e.g. adhering to carbon programmes; Cartmill, 2023), prevent pollution (e.g. purchasing non-toxic products; Wella, 2021), or minimise harm to the environment (e.g. training staff on pro-environmental behaviours; University of Southampton, 2019). Most opportunities to improve environmental quality were found to have some sort of positive synergy with circularity.

Social equity (17 %), denoting the promotion (or hindrance) of societal protection, transformation, strengthening, and development, including human wellbeing and job opportunities (Kirchherr et al., 2017), emerged as a significant aspect addressed through solutions; these involved worker safety and the transmission of diseases and pathogens. Social challenges in hairdressing are attended to in myriad ways. Health and safety training for hairdressers and barbers covers a variety of topics including proper handling of chemicals, correct glove use, prevention of occupational conditions like eczema and more.

Procurement choices like appropriate PPE as well as management strategies to adhere to health and safety legal requirements also address social equity. Though we found socially-oriented opportunities having positive synergies with circularity, we also found several negative trade-offs due to the necessity of non-recyclable or single use protective gear.

3.4. R-strategies in hairdressing

The examination of R-strategies in the hairdressing industry emphasised the prevalence of recycling as a favoured solution across both academic and grey literature (Fig. 5). Recycling in this industry involves off-site processing of end-of-life hairdressing products and packaging (e.g. metals, textiles, plastics; Green Salon Collective, 2023). Academic papers explored more innovative recycling approaches such as when salon wastewater is processed so that it can either be safely released to local water systems (e.g. wastewater treatment; Maifadi et al., 2022) or else used again on premises (e.g. greywater filtration; Swinson et al., 2013) as well as the recycling potential of hair (e.g. soil reinforcement; Sahu et al., 2019). A prevalence of discourse on recycling corroborates prior findings on the implementation of various R-strategies (de Jesus et al., 2021; Kirchherr et al., 2017; Reike et al., 2018).

Resource efficiency (i.e. reduce) strategies are less commonly focused on in the sample, however, our analysis revealed instances where reduction, as well as other R-strategies are mentioned in conjunction with recycling efforts, indicating a complementary relationship. These so-called synergies in our dataset illustrate the various pathways to achieve specific circularity goals. The remaining Rs, reuse and recover, receive little attention. While the scarcity of recovery activities is not problematic, given the relatively high value loss compared to the other R-strategies (Kirchherr et al., 2017), the lack of reduce and reuse strategies referenced in this industry is unfavourable as both are superior in preserving embedded value in terms of energy, labour and materials (Bocken et al., 2016; de Jesus et al., 2021).

Whilst most R-strategies are framed positively, there are instances where authors acknowledge they fail. ‘Reduce’, for example, is coded as a trade-off when resource use increases and, similarly, ‘reuse’ is coded as problematic when resource reuse poses a risk to human health (e.g. the reuse of sharps like straight razors). Recycling can go awry when, for instance, human hair reprocessing in India causes environmental degradation (Mondal et al., 2020) or when local Brazilian wastewater

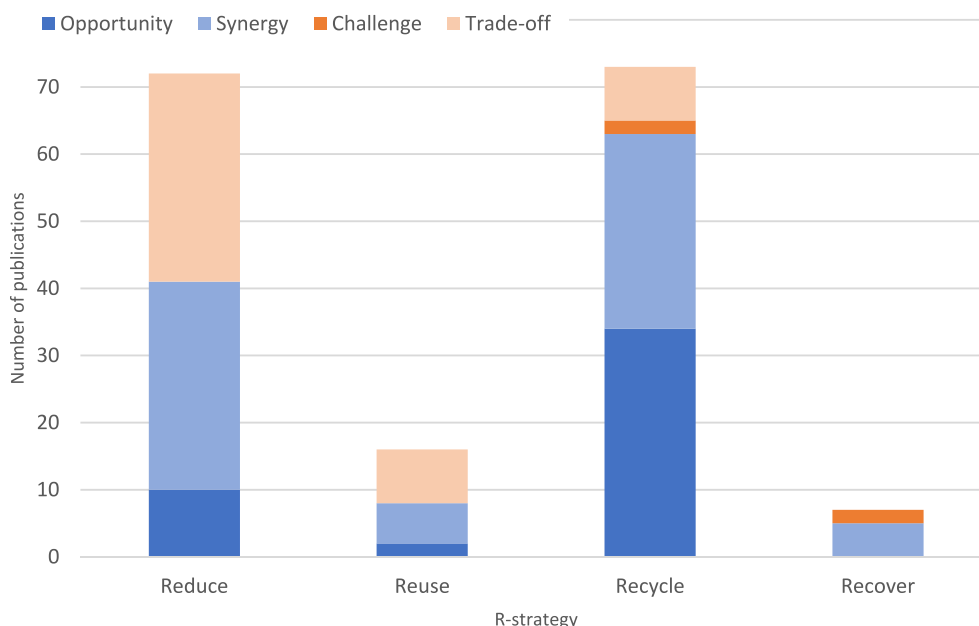


Fig. 5. R-strategies as challenges opportunities, synergies and trade-offs.

treatment facilities cannot sufficiently remove hair dyeing chemicals from drinking water (de Souza et al., 2020). Lastly, ‘recovery’ is coded as a negative when authors emphasise the inferiority of this strategy.

The exploration of R-strategies in hairdressing reveals greater complexities than are perhaps initially apparent. Though synergies with other R-strategies exist, evidence of the prevalent focus on recycling suggests a need in this industry for more integrated circular strategies. As acknowledged by numerous scholars (e.g. Allwood, 2014; Kirchherr et al., 2017), recycling must be seen as one option in a hierarchy of resource management strategies. Furthermore, instances of trade-offs highlight some of the inherent challenges in implementing these approaches. Our analysis reveals, for instance, how reduction and reuse strategies are often impeded by health and safety considerations. These findings stress the need for careful consideration and comprehensive approaches when employing R-strategies in the hairdressing industry.

3.5. Circularity and sustainability synergies and trade-offs in hairdressing

Upon mapping challenges and opportunities alongside identified synergies and trade-offs, notable patterns surfaced. Firstly, positive synergies which connect circularity and sustainability aspects in the sample became evident. Environmentally-focused solutions, for instance, linked strongly with favourable outcomes for circularity, whereas recycling solutions were commonly found to have positive associations with all other aspects. A multitude of positive connections between circular and sustainable strategies were found throughout the sample. These findings, coupled with previous studies (e.g. Morales et al., 2021; Valverde and Avilés-Palacios, 2021), collectively reinforce the notion that implementing circular and sustainable strategies can yield mutually beneficial outcomes.

More specifically, strong bidirectional links were found between recycling and environmental aspects. Authors reporting recycling efforts in salons, for example, often emphasise environmental benefits. This was an expected outcome given the prevalence of environmentally-focused approaches to the CE (Geissdoerfer et al., 2017). In addition, we uncovered strong links between resource efficiency and economic benefits which aligns with prior research highlighting that resource efficiency correlates positively with financial gains (Majid et al., 2023; Modi and Mishra, 2011). This has been found to be particularly true for SMEs, where investment in resource efficiency measures can enhance overall performance (Horbach, 2018).

By contrast, while most trade-offs are economic in nature, non-economic ones manifest at the social-circularity intersection. The unique challenges posed by regular physical interactions, often overlooked in CE research, underscore the distinctive nature of this industry. Service provision itself becomes the nexus where the most robust links between resource efficiency and health and safety are found along the hairdressing value chain. Our study shows, for example, that minimising resource consumption may trigger social issues (e.g. occupational illnesses) and, conversely, that implementing social solutions (e.g. safety protocols) may introduce new circularity hurdles, thereby making the reduction, reuse and recycling of certain resources less straightforward.

An intriguing revelation surfaced when we explored this connection between social challenges and circularity further. In one direction, we found several examples of circularity influencing social equity: in positive ways, like recycling programmes supporting social causes, and in negative ways, like ineffective or non-existent salon wastewater treatment resulting in toxic effluent—posing serious health risks to humans. In the opposite direction, we uncovered some socially-oriented solutions in hairdressing that at first glance have no influence on circularity, as in the case of using PPE to keep workers safe resulting in a circularity trade-off (i.e. increased use of disposable and often non-recyclable resources).

Several articles in our sample look at social challenges, usually occupational illnesses, where lack of PPE was coded as avoiding resource and waste. This observation highlights a paradox where unhealthy working conditions, resulting from reduced usage of specific

resources, inadvertently align with circularity objectives. Should our inquiry halt at this point, it might suggest that PPE presents a challenge to circularity, undermining its potential social benefits. Limiting our examination solely to the business domain may overlook broader and potentially systemic implications.

Closer scrutiny of the social side of this service industry unveils the value of adopting a systems perspective. For example, many of the articles investigating occupational illnesses like contact dermatitis and asthma reflect on the way these illnesses impact nearby healthcare systems. Some of these authors (e.g. Almasi et al., 2016) even calculate the cross-industry burden, putting dollars or euros to these social failures. A range of studies exploring workplace illnesses (e.g. Yokoyama et al., 2013) emphasise their systemic impact on healthcare and economies. It is thus crucial to understand the systemic impact of the social challenges in human-centric industries like hairdressing on wider economies, as they potentially contribute to resource use and waste. This perspective would also help to make the case that addressing social challenges like occupational risks to health may help to minimise resource use and waste in the wider economy.

3.6. Limitations

While this study aims to shed light on the application of CE strategies in the hairdressing industry, two key limitations should be acknowledged to contextualise the findings appropriately. Firstly, this study relies on academic and grey literature to capture all aspects of this industry’s dynamics and practices. As such, it does not quantify the extent to which the four investigated R-strategies are adopted. For instance, while recycling emerges as a prevalent theme in the literature, the actual adoption of recycling practices within the practitioner community remains unclear in quantitative terms. The prominence of recycling discourse may merely signify its appeal as a visible, outward-facing sustainability endeavour, aligning with societal expectations of responsible business conduct. Future research could involve surveys to quantify industry recycling rates or qualitative interviews with professionals to discover their perspectives of the challenges and opportunities for implementing various CE practices. Second, despite efforts to cast a wide net in literature selection, there may exist biases in the inclusion of articles, particularly regarding the identification of relevant CE-related content. This could impact the comprehensiveness of the insights gathered. Adopting a different CE definition or R-framework, for example, may well identify alternative challenges and opportunities. Additionally, examining industry-specific factors such as business size, location, and clientele demographics could provide further insights into the nuances of circularity in this industry.

4. Conclusions

Circularity encompasses more than just closing resource loops (e.g. recycling). To be effective, it also necessitates the implementation of narrowing (e.g. reducing) and slowing (e.g. reusing) strategies, while aligning with sustainability principles across environmental, economic and social dimensions. For that reason, this review explored the multifaceted manifestation of CE in a specific service-based industry. Using hairdressing as a contextual lens, it highlights the challenges and opportunities related to the employment of R-strategies and their interconnections with the three pillars of sustainable development.

Specifically, a scarcity of reported opportunities to address resource consumption was found in stark contrast to the prevalent focus on recycling opportunities. The industry’s overreliance on recycling demonstrates an unbalanced approach to circularity. The essence of the CE lies in curbing the unnecessary extraction of virgin resources. However, relying on recycling strategies to achieve this is akin to a dependence on solar geoengineering to combat climate change. Both approaches fail to address the root causes: climate change stems from various factors including our reliance on fossil fuels, whereas resource scarcity arises

from our unsustainable consumption of materials and products. While recycling holds merit, a bias toward resource loop closing strategies at the expense of resource slowing and narrowing strategies risks perpetuating patterns of unsustainable consumption. Thus, integrated approaches that combine these diverse strategies are required. Moreover, we identified cases where recycling efforts synergistically contribute to resource efficiency, which holds promise for the feasibility of more holistic circular approaches.

Our study shows the influence of hairdressing business activities on both CE practices and sustainable development. Repeated references to worker wellbeing within the literature, while expected due to the industry's human-centric nature, reveals an interconnectedness between CE and social aspects not typically acknowledged in the literature. Hairdressing and barbering professionals face a heightened risk of skin conditions like contact dermatitis from prolonged chemical, allergen and water exposure, alongside potential chronic respiratory issues due to consistent contact with various chemical agents. These risks demand the employment of protective gear which leads to additional considerations in managing resources and waste. The established links between worker safety, resource efficiency and waste management respond to an ongoing need for CE research conducted through a systems perspective.

Yet, a comprehensive systems perspective demands a broader scope. To fully appreciate the complexities of the CE, it is crucial to delve into these interconnections not only within industries but also across sectors and institutions. While our study presents evidence indicating how social challenges contribute to resource use and waste in wider economies, additional investigations are warranted to establish these connections explicitly. With this empirical evidence linking worker wellbeing to resource efficiency and waste, policymakers may introduce social innovations in their CE agendas. For example, they may offer incentives to businesses investing in localised extraction equipment or additional funding for targeted workplace health and safety programmes.

Finally, hairdressing serves as a catalyst for broader discussions on CE applications in services. Data gathered on the industry through various sources provide crucial perspectives to this end. Nevertheless, to deepen our understanding of CE applications in services, it is imperative to explore whether similar trends persist across diverse service industries. Future research endeavours should focus on assessing the feasibility of recycling strategies in other supplier-dominated service contexts as well as identifying bottlenecks to resource efficiency in other creative service businesses. Additionally, we recognise a need to deepen our understanding of the relationship between CE and health and safety, particularly in high-contact industries. By addressing existing gaps in the literature, this study lays the groundwork for more comprehensive investigations into the manifestations of CE beyond manufacturing.

CRedit authorship contribution statement

Stephanie Hodgson: Conceptualization, Methodology, Formal analysis, Investigation, Data curation, Writing – original draft, Writing – review & editing, Project administration. **Laura Piscicelli:** Conceptualization, Methodology, Writing – review & editing, Supervision. **Koen Frenken:** Conceptualization, Writing – review & editing, Supervision. **Ian Williams:** Conceptualization, Writing – review & editing, Supervision.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Stephanie Hodgson reports a relationship with Green Salon Collective¹ that includes: consulting or advisory. If there are other authors, they

declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.spc.2024.03.012>.

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¹ Green Salon Collective is a data source and is mentioned twice in this manuscript.

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