

**An Exploratory Study into Emerging Market SMEs' Involvement in the
Circular Economy: Evidence from India's Indigenous Ayurveda Industry**

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Abstract: This paper explores the extent to which SMEs can adapt and develop circular economy practices in an emerging market context. Since the evidence provided by the literature is mostly based on large firms operating in developed countries, our focus on India's indigenous Ayurveda industry allows a much-needed and nuanced lens through which to view circular economy activities. We use a two-step research design involving a systematic bibliometric analysis as a first step in the highlighting of numerous themes emanating from the circular economy literature. Second, we complement these insights with two case studies based on SMEs in the Indian Ayurveda industry. Our findings reveal that SMEs engage and contribute to the circular economy. More specifically, we present unique insights into the reasons, drivers, and motivations for SME involvement in the circular economy, wherein we observe a blending of indigenous practices and modern technology. Our findings allow us to propose several important implications for theory and practice.

Keywords: *Ayurveda, SME, emerging markets, circular economy, bibliometric analysis, qualitative case study, literature review*

1. Introduction

In the quest to become more socially responsible, many organizations, mostly larger ones, have been following ethical and sustainable practices for quite some time (Lahane, Kant, & Shankar, 2020; Yadav & Mankavil Kovil Veetil, 2021). These efforts to contribute toward the circular economy (CE) can be observed in various industries across the world. For example, Parida, Burstrom, Visnjic and Wincent (2019) show qualitative evidence of how resource-intensive manufacturing firms can work with their interdependent ecosystem partners to become more

sustainable and contribute to the CE. There is also recent evidence from the services sector (Sanguino, Barroso, Fernández-Rodríguez, & Sánchez-Hernández, 2020), construction sector (Benachio, Freitas, & Tavares, 2020), and the primary sector (Milios, Beqiri, Whalen, & Jelonek, 2019) that uncovers various unique approaches used by organizations to support the development of circular activities in the context of their business model innovations. Indeed, the CE has emerged as a popular approach to address sustainability concerns (Barreiro-Gen & Lozano, 2020) and can be defined as “*an industrial economy that is restorative or regenerative by intention and design*” (Ellen MacArthur Foundation, 2013, p.14). The CE considers waste as a resource and consists of activities such as reducing, repairing, reusing, recycling and remanufacturing (Barreiro-Gen and Lozano, 2020; Goyal, & Chauhan, 2020). The CE necessitates a shift from a traditional linear production–consumption path to a regenerative or closed loop path of production and consumption to attain harmony between economic and environmental interests (Merli, Preziosi, & Acampora, 2018).

Overall, this emerging and rich evidence portrays the diverse efforts by many firms and countries to transform from a linear economy to a CE. This transformation essentially involves the sustainable, cyclical, and regenerative use of all types of resources at different micro, meso, and macro levels and interactions between economic agents in a particular ecosystem (Kirchherr, Reike, & Hekkert, 2017; Kristensen & Mosgaard, 2020). However, the existing evidence and literature are focused primarily on larger firms, including multinational corporations (MNCs), while only a few, more recent, insights focus on small and medium-sized enterprises (SMEs) and highlight their essential role in the CE (Dey et al., 2019; 2020). Given that SMEs are the backbone of many economies worldwide and are an integral part of many supply chains of larger firms

regionally and globally, it becomes imperative to investigate the extent of their contribution toward the CE.

Another limitation on the current understanding of the CE is the lack of research on SMEs' activities, innovations, and strategies, particularly in emerging markets. These activities, innovations, and strategies are potentially different from those of developed markets. They can have a varying impact not only on SMEs themselves but also on the region in which they operate (e.g., van Loon & Van Wassenhove, 2020; Subramanian, Gunasekaran, Wu, & Shen, 2019; Dey, Malesios, De, Chowdhury, & Cheffi, 2020; Zhang, Venkatesh, Liu, Wan, Qu, & Huisingh, 2019; Salmenperä, Pitkänen, Kautto, & Saikku, 2020; García-Quevedo, Jové-Llopis, & Martínez-Ros, 2020; Agyemang et al., 2019). More specifically, we still do not know much about the role, involvement, and practices of emerging market SMEs in the CE context. For example, in India, unique traditions of sustainable business and management practices have deep historical roots in indigenous philosophies and knowledge systems. India has a rich cultural and intellectual heritage, such that both atomistic modernity and holistic indigenous systems, values, and traditions can coexist, which leads to integrated and hybrid forms of managing people and performance at work (Holtbrügge & Garg, 2016; Malik, Budhwar, Patel & Laker, 2021). The foundations of India's indigenous administrative and political practices can be linked back to a series of texts and compilations between the second and third centuries. The treatise by Kautilya, entitled *Arthashastra*, has a substantive set of procedural guidelines for the study and practice of politics, economics, government, military strategy, and ethical decision making in Indian culture (Chaturvedi, 2001). India has also been blessed with several other indigenous philosophical knowledge systems, including that of the *Ayurveda*, which prescribes a set of principles that humans should follow for conducting themselves. The *Ayurveda* focuses on transmitting the key

principles for living in a sustainable manner (Chaturvedi, Ghate & Deshpande, 2001; Sujatha, 2020).

However, from our first step, namely the bibliometric literature review, we identify that there is limited, scattered literature and evidence on the role of emerging market SMEs in the CE and, hence, we aim to contribute to the literature by overcoming this research gap. We focus particularly on the indigenous Ayurveda industry in India, which is a medical system with roots in ancient Sanskrit language texts dating back thousands of years. As a second step, we complement the insights drawn from our bibliometric analysis with two case studies based on SMEs in the Indian Ayurveda industry. Within this traditional industry context, we are keen to understand how SMEs adopt CE practices. In summary, our paper, through the above two steps, investigates the following two research questions (RQs):

RQ1: What are the key research themes explored in the literature on the CE?

RQ2: Within the indigenous Ayurveda industry, what are the practices adopted by emerging market SMEs to enhance their involvement in a CE?

There are five pivotal ways in which we contribute through this paper. *First*, this paper explores the extent to which SMEs operating in niche, traditional and historical industries like the Ayurveda industry in emerging countries, such as India, have been adapting and developing CE practices. *Second*, we investigate SMEs and develop the scant literature on CE practices in the SME context, as prior research has predominantly concentrated on large firms operating in developed countries. Thus, our focus on SMEs in India's Ayurveda industry offers a nuanced lens to view CE activities. *Third*, we contribute to the research on CE by bringing together a scattered research field through a bibliometric review of the CE knowledge base. This helps to understand how the knowledge–research base of the CE field is structured, taking into account its underlying

features and explanations along with the conceptual structure of the field's entire research base (which includes research articles, review papers, books, and book chapters). We have done this by using robust bibliometric metadata of the research field. Our *fourth* contribution is methodological, as we use a two-step research design involving the above systematic bibliometric analysis. This analysis highlighted the research gaps, which were then redressed by investigation of important sources of insight. That is, we substantiated and complemented our first step by conducting two representative case studies of SMEs in the Indian Ayurveda industry in a detailed and critical manner. *Fifth*, we have contributed through our findings, which provide evidence that SMEs from the Indian Ayurveda industry engage and contribute to the CE. Specifically, we present unique insights into the reasons, drivers, and motivations for SME involvement in the CE, wherein we observe a blending of indigenous practises and modern technology.

The rest of the paper is organized as follows. First, we provide an overview of our bibliometric analysis of the literature on CE. This section is followed by a review of the role of CE in emerging markets, particularly as it works in SMEs. Next, we present details of the methodological approach and analysis of the data. Finally, we discuss the implications of our conclusions for theory, practice, and future research.

2. Literature review

2.1 An overview of the CE knowledge base

To understand how the research base of the CE is structured and what the underlying features and explanations of this field of research are, the conceptual structure of the entire research base (which includes research articles, review papers, books, and book chapters) of the CE was mapped using bibliometric metadata of the research field (Figure 1). Grasp of a research field's conceptual structure aids understanding of its underlying features and explanations and their various functions.

The organization of these underlying features helps in understanding a research field's essential and recent themes and issues (Aria and Cuccurullo, 2017). A co-word analysis approach was followed, using a bibliometric package in R software to construct a strategic diagram (see Figure 1 below) of the CE research field (Aria and Cuccurullo, 2017; Zupic and Čater, 2015; Bamel et al., 2020a, 2020b, 2021).

Insert Figure 1 about here

Figure 1 is a two-dimensional matrix that divides the CE research base into four types of theme (i.e., motor, basic, specialized/niche, and emerging or disappearing) based on density and centrality rank values (Cobo, López-Herrera, Herrera-Viedma, & Herrera, 2011)). The strategic diagram of CE scholarship presents one motor theme (industry 4.0 & sustainable value creation), one partial motor and base theme (waste management), one partial motor and transverse theme (reuse, repair & recycle), three base themes (circular economy, literature review, barriers & drivers), three transverse themes (business model, leather industry & environment, ethics & sustainability) and two emerging or disappearing themes (resource recovery assessment, multicriteria decision making).

CE research's strategic diagram has one motor theme named industry 4.0 & sustainable value creation (upper right quadrant). This theme is considered to be a well-developed theme, one important and central to CE research. Published articles relevant to the theme industry 4.0 & sustainable value creation relate to the business model innovation for value performance and sustainability (Planing, 2018; Roos & Agarwal, 2015). For example, this theme explores how CE practices, supply chain management design, and innovation facilitate organizational performance and sustainability (Del Giudice et al., 2020). Other themes include the environmental impact of

CE-driven business models. This research mainly addresses the CE's environmental and economic viability and identifies CE applications' success factors (Ghisellini et al., 2018; Hossain & Ng, 2018).

Another motor theme (partial) is waste management, which appears to transit from the basic quadrant to the motor quadrant. A possible interpretation is that the theme of waste management is not yet fully developed. This theme's publication timeline is 2016 to 2021, with the rate of publication increasing year by year. Primary research in this theme includes waste management, reverse logistics, food waste, smart waste management, and packaging. Scholars whose publications concern waste management have undertaken inquiries into numerous areas, such as barriers to smart waste management in a CE context (Zhang et al., 2019); identification of CE assessment indicators (e.g., resource consummation intensity, waste emission intensity, waste recycling intensity and waste disposal rate) for CE performance evaluation of cities (Guo et al., 2017); luxury products within the CE (Bundgaard & Huulgaard, 2019); reverse logistics in the food supply chain (Kazancoglu, Ekinici, Mangla, Sezer, & Kayici, 2020) and so on. An emerging area of research in this theme is big data applications and the internet of things in waste management practices (Fatimah, Govindan, Murniningsih, & Setianan, 2020).

Another partial *motor* theme is *reuse & recycle*, and the main research issues in this theme include sustainable consumption (Testa, Iovino, & Iraldo, 2020), labelling for promoting consumer choice for reuse and recycle of ICT products (Gåvertsson, Milios, & Dalhammar, 2020), and efficient energy consumption in an industrial establishment (Ali, Wang & Alvarado, 2019). Research in this theme addresses value creation and co-creation, business model innovation, reuse, recycling, and waste management. Most of its research was published from 2014 onward and it

continues to grow. Case studies, literature reviews, and exploratory studies are the dominant forms of inquiry in the *motor* theme.

The base theme (right lower quadrant) constitutes themes such as *CE*, literature review, and barriers and drivers. Primary research inquiries in these themes concern sustainability and sustainable development (Murray, Skene, & Haynes, 2017), resources efficiency, life cycle assessment (de la Caba et al., 2019), economic and environmental sustainability, energy recovery, barriers and drivers of *CE* practices, circular design and *CE* research in emerging economies (van Loon et al., 2020), new product development (Subramanian et al., 2019) and adoption of *CE* practices in SMEs (Dey et al., 2020). Lack of regulatory pressures, lack of environmental education and culture of environmental protection, and lack of market pressures and demands (Zhang et al., 2019) are among the list of barriers in an emerging market context. The majority of inquiries in the base theme quadrant are exploratory, indicating that knowledge in this field is emerging. For example, the barriers and drivers research has endeavored to identify various drivers of *CE* practices in a variety of contexts, such as critical factors for promoting *CE* in waste management (Salmenperä et al., 2020); *CE* adoption barriers in a European-SMEs context (García-Quevedo et al. 2020); drivers and barriers of *CE* activities in Pakistan (Agyemang et al., 2019) and so on. Research in this theme is in a growth phase.

The peripheral research quadrant (upper left quadrant) is comprised of research themes, namely ethics and sustainability, leather industry and environment, and business model. This quadrant is considered peripheral, based on density and centrality rank value. That is, it is seen as scattered and non-central to the research field. Issues that are addressed in this quadrant include business ethics and sustainability (Flores, Bressers, Gutierrez, & de Boer, 2018), rainwater harvesting and water governance (Espíndola, Cordova, & Flores, 2018), *CE* activities and practice

in the leather industry (Moktadir et al., 2020), waste hierarchy, landfilling (Nascimento et al., 2019; Veleva, Bodkin, & Todorova, 2017) and so on. Our review shows that research issues in this cluster are scattered both in terms of publication timelines and scope, except for the issue of CE in leather industries. CE research in the leather industry is almost a decade old and has recently received increased attention. This indicates that CE research is moving towards contextualization—for example, CE in the leather industry and CE in farms.

The next theme (Figure 1) is the emerging or disappearing theme and positioned in the lower-left quadrant. This quadrant's research theme includes CE strategies (Elia, Gnoni, & Tornese, 2017; Elia, Gnoni & Tornese, 2020; Nikanorova & Stankevičienė, 2020), environmental indicators, resource recovery assessment, material flow assessment, and sustainable assessment. Our analysis reveals that measurement and assessment of CE practises, CE initiatives, and strategies form an essential emerging research theme, generating many inquiries into matters such as the metrics of the CE economy (Parchomenko, Nelen, Gillabel, & Rechberger, 2019), CE assessment (Nikanorova et al., 2020); and evaluation of adoption of CE practices (Elia et al., 2020). Some other emerging issues are business model innovation for CE; environmental improvements; contextualization of CE research ranging from large industrial set-ups to SMEs (Dey et al., 2020; Ünal, Urbinati, & Chiaroni, 2019)—for example, cottage industrial units such as the wooden furniture industry (Susanty, Tjahjono, & Sulistyani, 2020) and olive oil (Galati, Scifani, Crescimanno, Vrontis, & Migliore, 2018); CE practises' adoption in an emerging economy (Cezarino, Liboni, Stefanelli, Oliveira, & Stocco, 2019); CE in niche contexts such as luxury goods and pig farming; and value creation and addition by design (Ali et al., 2019; Bag, Dhamija, Gupta, & Sivarajah, 2020; Patwa et al., 2021; Yadav, Mangla, Bhattacharya, & Luthra, 2020).

Now that we have established a broad picture of CE research, we will explore and assess the current state of evidence on the operation of the CE in emerging markets' SMEs

2.2 CE in Emerging Market Context

There is evidence of significant adoption of CE principles by emerging markets such as India. One of the key drivers of adoption of CE and corporate social responsibility (CSR) practices in India was the enactment of Section 135 of *The Companies Act 2013*, which made CSR a mandatory requirement for companies having a net worth above 5 billion INR, or turnover more significant than 10 billion INR, or a net profit higher than 50 million INR during any of the last three financial years (*The Gazette of India*, 2014). Such a regulatory impetus has resulted in several large- and medium-sized business houses investing in a range of CSR activities (Sahasranamam, Arya & Sud, 2020), many of which are also aligned to the United Nations (UN) sustainability development goals (SDGs). Indeed, many other stakeholder organizations, such as the Ellen MacArthur Foundation, note the potential benefits for the Indian economy from the CE concept, which could lead to an annual wealth creation potential of US\$624 billion (MacArthur, 2013).

It is noteworthy that many sizeable traditional Indian business houses have established philanthropic arms such as the Reliance, Tata, Wipro, ITC, and Birla business groups. They have embarked on reporting their CE initiatives in their annual reports and signalling to their key stakeholders (Agrawal & Sahasranamam, 2016). For example, there is a list of CE initiatives adopted by the Tata and Birla business houses based on the CE principles of reducing, reusing, recycling, refusing, and repurposing (Tata Sustainability Group 2020; Sustainability Report, 2020). While the mandatory allocation of surpluses toward investments in sustainability and CE initiatives has helped large emerging market firms and MNCs set up standalone infrastructures, the SME sector in the Indian context does not benefit from any significant regulatory mandate

(Sahasranamam & Ball, 2018). As part of their overarching thematic focus on CE activities, larger business houses' philanthropic arms extend support to SMEs in their value-chain to embrace some of the CE principles. However, for SMEs not associated with larger business houses' value chain, the lack of both government incentives and understanding of entrepreneurial benefits of CE adoption on their own part acts as a deterrent to investment in CE activities by most SMEs. One industry whose culture and philosophy immunize it from these structural and cognitive barriers is the ancient practice of Ayurveda, which, in its very essence, focuses on holistic and sustainable practices.

2.3 *Ayurveda and Indigenous Indian Management*

Ayurveda, the science of life, is an ancient system of medicine that originated in India about 5000 years ago (Mishra, Singh & Dagenais, 2001). Knowledge of this medical system comes from Sanskrit language texts called *Vedas*. Ayurveda focuses on the “use of natural means such as diet, herbs, spices, minerals, exercise, meditation, yoga, mental hygiene, sounds, smells, and mechano-procedures to eliminate the root cause of the disease” (Parasuraman, Thing, & Dhanaraj, 2014, p. 74). The early texts of Ayurveda are *Charaka Samhita* and *Sushruta Samhita*, with the former discussing causes of diseases and the latter describing Ayurvedic surgery and its techniques (Tiwari, 2007).

The fundamental philosophy behind this holistic system is the harmony between body, mind, and soul. Ayurveda emphasizes the prevention of disease by leading a healthy life in preference to prescribing different forms of treatments. However, it also includes many treatment protocols and medicines to address various illnesses and conditions. According to the Ayurvedic medicine system, human beings are made of the five essential elements together termed *Pancha Bhoota*. The five elements are *Prithvi* (Earth), *Jal* (Water), *Agni* (Fire), *Vayu* (Air), and *Akasha*

(Space). The synthesis of these five elements causes a unique mix of three types of energies known as *Doshas* in each individual. The three *Doshas* are *Vata* (Space and Air), *Pitta* (Fire and Water), and *Kapha* (Water and Earth). An imbalance of these *Doshas* results in illness. Therefore, according to Ayurveda, balancing the doshas through spiritual nurturing and herbo-mineral formulas ensures a harmonious state of being (Mishra, Singh & Dagenais, 2001).

There are eight branches of Ayurveda treatment, namely *Kaya Chikitsa* (internal medicine), *Shalya Tantra* (surgery), *Shalakya Tantra* (ear, nose, throat and eye diseases), *Kaumarbhritya* (pediatrics), *Agada Tantra* (toxicology), *Bhuta Vidya* (psychiatry), *Rasayana* (rejuvenation therapy) and *Vajeekarana* (aphrodisiac therapy) (Parasuraman, Thing, & Dhanaraj, 2014). Ayurveda uses the *Panchakarma* (“five actions”) procedure in its therapies, which involves *Virechan* (purgation through the use of powders, pastes or decoction), *Vaman* (forced therapeutic emesis by use of some medicines), *Basti* (use of enemas prepared from medicated oils), *Rakta moksha* (detoxification of blood) and *Nasya* (administration of medicines like decoctions, oils and fumes through the nasal route) (Jaiswal & Williams, 2017).

The application of indigenous management practices has been followed by many Ayurveda centres and healthcare providers (Malik, Budhwar, Patel, & Laker, 2021). This is not surprising because, as Holtbrügge and Garg (2016) note, there is evidence in both broad Indian governmental policies and modern Indian business values of the myriad socio-political, cultural, and religious influences of authentic Vedic scriptures. *Bhagavadgita*, one of the three fundamental texts of Hinduism, provides rich insights into Indian culture and presents an overarching framework for developing Indian business systems (Mishra & Varma, 2019). Based on a holistic perspective, *Bhagavadgita* provides precise prescriptions for leadership, anger management, stress management, and management of work (Bhawuk, 2019). A focus on indigenous ‘Indianness’ is

now evident in the local and global operations of some firms (Laleman, Pereira, & Malik, 2015). The spirituality embedded in Indian management systems provides an organic perspective deriving from higher consciousness to business leaders (Sharma, 2019). For a recent account of modern and indigenous Indian management practices, we direct the reader to Budhwar, Varma, and Kumar (2019) and Malik et al. (2021).

Our decision to use SMEs operating in the Ayurveda industry as our case studies is a logical one because of this industry's emphasis on sustainability practices. We provide below the justification for our methodological choice, some details of the two case organizations selected for this research, and the data collection sources and analyses.

3. Methodology

As our paper is based on a dual methodology, we present the two methods adopted here. Our first methodology comprised a bibliometric analysis, a method that is well recognized and used extensively in various disciplines to analyze bibliometric metadata knowledge bases (Baker, Pandey, Kumar, & Halder, 2020; Zupic and Čater, 2015). Bibliometric analysis is considered to be a quantitative and more objective form of literature review that helps the understanding of a knowledge domain (Khan et al. 2021). This paper's bibliometric metadata was retrieved from Scopus© in December 2020 while following the established data retrieval protocol for systematic literature reviews (Jones, Coviello, and Tang, 2011). We retrieved the relevant data from the SCOPUS database using a combination of keywords in the title, abstract, and keyword fields. We chose SCOPUS because it is the largest multidisciplinary database of peer-reviewed literature in the social sciences (Bartol, Budimir, Dekleva-Smrekar, Pusnik, & Juznic, 2014; Norris & Oppenheim, 2007). Our search string included "circular economy," limiting this search to relevant business management and document types (research articles, review papers, and book chapters

only). This search string yielded 542 relevant research documents. Next, we developed the strategic map of the research field using the keyword “co-occurrence” and, for this purpose, we used the Bibliometrix R package (Aria & Cuccurullo, 2017).

We classified SMEs in an Indian context, on the basis of the definitions found in the website of the SME Chamber of India (<https://www.smechamberofindia.com/>) as follows:

- Micro enterprise category: INR 1 crore (10 million) of investment and INR 5 crore (50 million) of turnover
- Small enterprise category: INR 10 crore (10 million) of investment and INR 50 crore (500 million or half a billion) of turnover
- Medium enterprise category: INR 50 crore (500 million or half a billion) of investment and INR 250 crore (2.5 billion) of turnover

Following the literature review based on our bibliometric analysis, our second step involved focusing on expert insights from two indigenous Ayurveda SME case study organizations operating in India. For the case-study part of the method, we collected and analyzed the data qualitatively from the case organizations, following Yin (2003) and Miles and Huberman (1994). Although we acknowledge the works of several prominent case-study theorists covering traditions as diverse as critical realism, positivism, social constructionism and interpretivism (see, for example, George & Bennett 2005; Flyvbjerg 2006; Welch, Piekkari, Plakoyiannaki, & Paavilainen-Mäntymäki, 2011; Poulis, Poulis & Plakoyiannaki, 2013; Stake 2013), we ground our case analysis more firmly in those theories that employ an abductive approach (Dubois & Gadde,

2002; Eisenhardt & Graebner, 2007), whereby the researchers go back and forth iteratively between known theory, adopted method and the data collected from the field to clarify and analyse.

There are several levels at which we have justified our choice of theoretical sampling of our two different cases (Eisenhardt & Graebner, 2007). For example, following a theoretical sampling technique is appropriate for supporting replication, theory extension, contrary explanations, and removing alternate explanations (Yin, 2003). Given that the purpose of this research is to extend and develop new contextualized theorizations of CE practices from an emerging market context, our focus on theoretical sampling is logical (Eisenhardt & Graebner, 2007).

As Eisenhardt and Graebner (2007) note, theoretical sampling allows researchers to suitably illuminate the nature and logic of relationships between context-specific constructs and the forms of influence exerted by these constructs, such as, for example, the effects of CE in an emerging market context. As Eisenhardt and Graebner (2007, p. 27) emphasize, *“A particularly important theoretical sampling approach is “polar types,” in which a researcher samples extreme (e.g., very high- and very low-performing) cases to more easily observe contrasting patterns in the data. Although such an approach can surprise reviewers because the resulting theory is so consistently supported by the empirical evidence, this sampling leads to very clear pattern recognition of the central constructs, relationships, and logic of the focal phenomenon.”* The choice of our cases is motivated by how effectively these cases inform and extend the existing theoretical understanding of CE practices by firms from emerging markets such as India.

Our choice of SMEs from an indigenous industry such as Ayurveda, therefore, is timely, as there is currently limited understanding of this industry’s management practices, including CE adoption and implementation. The industry primarily operates in three key ways: providing cure

through medicinal Ayurvedic concoctions and products; operating care centres (wherein the patient undergoes treatment as either an out-patient or in-patient); and, finally, by adopting a holistic approach to Ayurveda that incorporates both care and cure under the same roof. The last approach has its variants too, arising from differences in duration of stay and differences between holism and popular approaches, though it should be noted that a holistic and longer-term observational approach is closer to the authentic principles of Ayurveda. We provide examples of the industry's first two sub-sectors: cure (focusing on the manufacture of products) and care (providing an integrated treatment facility).

Given the relatively small size of the case organizations by Indian standards, we interviewed key informants, analyzed secondary data in organizational records and combed information available from their websites. We provide an overview of the case organizations and then offer our subsequently developed theoretical themes on CE.

3.1 About the Case Organizations

Case 1: Pankajakasthuri Herbals India Private Limited

Dr. J. Hareendran Nair started Sree Dhanvanthri Ayurvedics in 1988 and then rechristened it as Pankajakasthuri Herbals Indian Private Limited in 1996 with the vision of “achieving complete healthcare and harmony of body, mind, and soul through Ayurveda.” The company followed the use and processing of raw materials outlined in the ancient Sankrit manuscripts. The drug that they produced based on these guiding texts subsequently underwent an approval process of drug licensing before being marketed. In 2000, it became the first company from Kerala dealing in Ayurvedic medicine to get ISO 9000 certification. The main manufacturing plant is in Poovachal in Thiruvananthapuram, Kerala¹. Currently, Pankajakasthuri has around 300 employees in its

¹ Retrieved from: <https://www.pankajakasthuri.in/about-pankajakasthuri?divisions>

production plant². The company's work in Ayurveda and its R&D has been recognized by multiple awards, including the National MSME award in 2009³. Pankajakasthuri has four main divisions—over-the-counter products, ethical products, classic products, and Fast Moving Consumer Goods (FMCG). Dr Hareendran and his close family own and manage the operations of the organization.

Pankajakasthuri's products' manufacturing process starts with collecting raw materials, comprised of herbs, shrubs, leaves, roots, flowers, and seeds of medicinal plants as outlined in Ayurvedic scriptures. These plants are sourced either through vendors from around India or grown in the 13-acre Pankajakasthuri herbal gardens⁴. Their manufacturing process blends the principles outlined in Ayurvedic scriptures with modern production technology and machines. For instance, Pankajakasthuri's initial recognition came from *BreatheEasy*, an over-the-counter (OTC) product for treating breathing troubles, which merged traditional medicinal knowledge with modern technology processes to develop medicines as granules that are more palatable to consumers than *kashayam* (a thick liquid mix obtained through heating and blending of raw materials).

The medicinal plant-based raw materials are likely to have fungal, bacterial, and metal elements and need to be cleaned with large quantities of water. The primary source of water is borewells or open wells. However, mindful of water sustainability, Pankajakasthuri employs a water-treatment plant for filtration of used water. This water-treatment plant removes bacteria and other contaminants from used water, allowing it to be reused in the raw-material cleaning process.

Once the raw materials are cleaned, slightly different manufacturing processes are followed, depending on a product's nature. In most products, *kashayam* preparation is a common

² According to US Small Business Administration (2016), firms employing fewer than 500 employees are classified as small businesses.

³ Retrieved from: <https://www.pankajakasthuri.in/Awards>

⁴ Retrieved from: <https://www.pankajakasthuri.in/about-pankajakasthuri?divisions>

initial step, which involves high-temperature heating and blending of raw materials. In some instances, the *kashayam* is liquefied through extraction and bottled. However, the most common products of Pankajakasthuri are sold in the form of granules or tablets.

A key source of Pankajakasthuri's success came from making Ayurveda palatable. *Kashayams* in their raw form are very bitter, and their transformation into granules or tablets through modern technology has made them easier to consume. The company has a team of scientists involved in the identification and sourcing of raw materials from around India, which is complemented by an R&D department with established standards for process control and toxicological and clinical studies⁵.

Case 2: Sree Subramanya Ayurvedic Nursing Home

Sree Subramanya Ayurvedic Nursing Home (SSANH) was founded in 1972 by Thekkayil Rajaratnam Vaidyar in Kozhikode district, Kerala, India. It began with only two rooms from where it provided consulting services and dispensing of medicines. *Vaidyar* is a Malayalam word referring to ayurvedic practitioners and is often used as a surname by them. Rajaratnam Vaidyar's father and grandfather were famous *vaidyars* who treated patients with severe illnesses like cholera. Kozhikode had only minimal medical treatment facilities during these men's professional lives; hence, many people relied on *vaidyars* for medical treatment. SSANH moved to the current location in 1978 and established an ayurvedic nursing home with six rooms. These premises were probably the first ayurvedic nursing home with an in-patient treatment facility in Kozhikode. The family built a new facility in that location in 1998 and enhanced the treatment facilities. Dr. Sanand

⁵ Retrieved from: <https://www.pankajakasthuri.in/about-pankajakasthuri>

Ratnam, son of Rajaratnam Vaidyar, completed his degree in ayurvedic medicine in 2004 and joined his father's practice. They constructed two more floors for their nursing home.

A new firm, Sree Subramanya Ayurvedic Products, with Dr. Ratnam and his wife as partners, was registered in 2008 for manufacture of high-quality medicines. The Ratnams do not sell these commercially. They obtained green leaf certification from Kerala's government, and became empanelled by the income tax department and the Central Government Health Scheme (CGHS) of the Indian Government. They became the first ayurvedic hospital in Northern Kerala to obtain accreditation from the National Accreditation Board for Hospitals and Healthcare (NABH) in 2017. Many leading public sectors and government organizations empanelled them for provision of treatment to their employees. The number of patients from India and abroad increased significantly, and they focused on curing many troublesome illnesses through excellent treatment.

In many cases, they have been able to cure patients to whom surgical treatment options were suggested by doctors practicing modern medicine. Their total turnover is approximately INR 24 million, out of which products account for about INR 4.5 million. They currently have 35 employees. They are also engaged in charitable activities by providing free treatment to many deserving patients. Although a trust was formed to facilitate charitable and CSR activities, this initiative has not been as beneficial as hoped, primarily due to government regulations. About ten years ago, they bought eight acres of land in Vaylada near Kozhikode to cultivate herbs to make ayurvedic medicines. They also plan to acquire more land and build hill-top cottages on this new property to provide ayurvedic treatment to patients, especially patients from abroad. Dr. Ratnam has decided to set up another company in partnership with one of his friends, a PhD from the United States, to manufacture and sell high-quality ayurvedic medicines.

SSANH has optimized its workforce during the COVID-19 crisis by redeploying many employees and promoting multitasking. The food waste from the canteen used to be removed by staff from Kudumbasree, a non-governmental organization (NGO), at regular intervals. They were paid INR 3000 per month for removing this waste. This waste is now regularly being taken away free of charge by a pig farm to be used as animal feed, resulting in some cost savings. The company has also found ways of reusing the oils used for treatment and the waste produced while manufacturing medicines. Dr Ratnam is keen on having a greater level of mechanization at the drug manufacturing plant. He feels that reducing the ingredients needed to make medicines could be possible by automating the manufacturing processes. SSANH has bought some machines that would enable them to make excellent powders of some vital ingredients used to produce medicines.

Due to mechanization, the nursing home has been able to increase its operational efficiency and reduce waste significantly. Previously, it used firewood for heating during the drug-manufacturing process. By using cooking gas, the home has been able to reduce atmospheric pollution. However, it still produces some medicines used for particular purposes in limited quantities on the premises by following the traditional process of using the specific types of firewood stipulated for those types of medicine. Now the company is forced to add preservatives to some medicines to improve their shelf lives and reduce wastage.

Recycling the materials used for the therapies is impossible in ayurvedic nursing homes because doing so might hamper the quality of the treatments provided. Therefore, according to Dr Ratnam, there is a need to research ways to reduce medicines' usage to treat different illnesses. As he said, *“Instead of using three or four different medicines to treat an illness if it is possible to treat it using one or two medicines, the resource consumption can be reduced significantly.”* By employing such a strategy, doctors and therapists can ensure the quality of a smaller number of

medicines rather than focusing on a wide variety of medicines. Another strategy involves ensuring medicines' palatability for ease of consumption. This approach may also reduce wastage of medicines. Dr Ratnam emphasized the need for development and implementation of such well-planned strategies to popularize ayurvedic treatment.

4. Data Analysis

Several CE themes emerged from our interviews with the key informants. We now provide a discussion and analysis of the themes inherent in the principles of Ayurveda and their surrounding philosophy of harmony with nature. The selected owners and lead practitioners have reflected this philosophy in their managerial policies, as was readily discernible in the practices of their organizations. Specifically, we noted CE themes in both resource use and product or service creation (see Figure 2 below).

Insert Figure 2 about here

4.1 Reducing Resource Usage

Concerning the usage of raw materials, Pankajakasthuri has undertaken R&D on physical and chemical formulations and blended that knowledge with advances in modern technology. These initiatives have reduced the herbs' volume and the amount of other ingredients needed to develop products with the same efficacy and quality. Advancements in agricultural research have also helped in this regard, as shown by the following example given by one of the interviewed subjects:

“For example, Koovalam (a medicinal plant) takes 20 years to grow, it is a big tree, 1000 kg tree—say we get 200-300 kg of root. But that takes a long time. So now we have the necessary agricultural technology to grow roots alone in 6-inch PVC pipes filled with

soil. There is a particular type of culture, agriculture technique. Using this, we get in 3 years, 12 feet Koovalam root; it is supported by the agriculture department, we partner with them. We use 15 inches long and 6-inch wide pipe and develop Koovalam root in that. We easily get 15–20 kg in 3 years now. This is done for the last 5 years. From their testing, we have assured that these roots are also of the highest quality.”

As explained earlier, SSANH redeployed its workforce and promoted multitasking during the COVID-19 crisis, resulting in a significant reduction in resource usage. Mechanization of the manufacturing processes helped them reduce the consumption of herbs and other ingredients needed to produce medicines. Dr Ratnam feels that more R&D efforts are needed to reduce the consumption of resources used to produce medicines, oils, and other materials to provide ayurvedic treatment.

“We can use the locally available materials like certain types of soil, stones, and also some materials from coconut tree to make ayurvedic medicines.”

By using locally available materials, the cost of the resources can be reduced significantly. He said that materials sourced from different locations contain many adulterants. By use of locally available materials, the quality of the medicines and therapies can be improved.

4.2 Revamped Energy Processes

In the manufacturing process, Pankajakasthuri has transitioned from a firewood-based heating approach to thermal-fluid heating. This transition has both environmental and health benefits resulting from the absence of smoke generated by the previous process. In the thermal-fluid heating approach, workers can operate the equipment with limited health risks and no extreme heat exposure. Also, the thermal-fluid heating approach is an energy-efficient process. In recognition

of such efforts, they received the state government's energy conservation award in 2009⁶. The manufacturing process followed at Pankajakasthuri has evolved in other ways over the years, as is evident in the CEO's words:

“In the initial days, Ramu (name changed) and Rajan (name changed) vaidyars (ayurvedic doctors), and Raju (name changed) as paricharikan (helper) were at the centre of their process, and their trust was the basis of kashyam (medicine). Even patients were from the village of the vaidyar, they had trust in him, and so they bought it. Now, when we have a larger business, there is no relation between producer and buyer, so it is a quality standard GMP system that works, consistency in quality is important. We have standard operation procedure, GMP standard, ISO certification, and we follow that.”

The energy process experience of SSANH is similar to that at Pankajaksthuri. That is, before a change of approach, the medicines used to be made by burning firewood. Dr Ratnam explained the difficulties they faced:

“Availability of good firewood is a problem, difficult to dry the wet firewood. Sometimes firewood from poisonous trees like cheru maram (Holigarna) and even rubber trees are mixed with other firewood. Burning firewood from poisonous trees is dangerous. Firewood from other trees like rubber trees will not produce uniform heat and sometimes produces too many dust particles”.

Due to these difficulties, they switched to cooking gas and, consequently, the efficiency of the operations improved substantially. The atmospheric pollution due to the burning of firewood was also reduced due to this decision. SSANH has to repaint the patient rooms and therapy rooms

⁶ Retrieved from: <https://www.newindianexpress.com/cities/thiruvananthapuram/2009/dec/18/energy-conservation-awards-announced-114112.html> accessed on Dec 14, 2020

every six months because the walls get dirty due to the oils and other therapeutants used for treatment.

“Being an ayurvedic nursing home, we spend quite a lot of money on painting the walls every year.”

The company has fixed ceramic tiles on the walls of many patient rooms and therapy rooms. Dr Ratnam hopes to complete this process soon. He and his staff will be able to reduce the frequency of painting once this activity is completed.

4.3 Revised Manufacturing Processes

Pankajakasthuri has also introduced new proprietary technology to its manufacturing process to redesign it to reduce the volume of resources used and develop more specific medicinal products. Fluid-processing technology is a commonly used approach in the Ayurvedic industry to process the *kashayam* into powder. Pankajakasthuri designed and developed tunnel-dryer equipment to replace fluid-processing technology. This tunnel-dryer process needs half the quantity of resources for medicinal tablets of the same efficacy and takes less processing time. This process has reduced resource loss, as is stated by the CEO:

“In tunnel-dryer processing, tonight’s kashyam starts, tomorrow afternoon, tablets or granules are in the box (ready for selling). The other processes take longer time and quantity for a tablet is double. Thus loss is much less, and we are more precise compared to fluid-processing technology. The fluid-bed processing is not a failure. It is just we have developed a more advanced technology tailor-made for our use in tunnel-dryer technology. We mentioned temperature, materials and requirements, and designed it exclusively for that. We were motivated to do this given the understanding of limitation in quantity and time with the other technology.”

At SSANH, Dr. Ratnam initiated a drive, after he joined the company, to mechanize the manufacturing of medicines.

“When I joined my father to run the nursing home after completing my medical degree, I noticed that almost twelve workers were working throughout the day to crush the herbs to make an ayurvedic oil.”

He was worried by the lack of productivity in the manufacturing process and the wastage of herbs and other ingredients needed to make medicines.

“I bought a juice and pulp extractor manufactured by Pilotsmith.”

This decision was one of the significant initiatives Dr Ratnam made to modernize the processes used at SSANH, resulting in a significant reduction in consumption of key ingredients and increased productivity.

4.4 Recycled waste as a resource

The waste created at the end of the manufacturing process, called *chandi*, can be recycled for multiple uses, as has been shown at Pankajakasthuri. First, a pressing machine compresses this waste arising from the primary manufacturing process. The compressed waste is subsequently dried and used in the thermal fluid heating process as fuel. Second, the waste can be used as agricultural manure after mixture with cow dung and ash. In earlier days, Pankajakasthuri had a separate retail outlet in the manufacturing plant that sold this manure. Since a significant portion of the waste is now being used in the manufacturing process itself as fuel, the separate retail outlet is no longer operating. However, a minor portion of the remaining waste is still kept at a separate location outside the manufacturing plant, and people from the community continue to use it as agricultural manure for free.

At Pankajakasthuri, the motivation for sustainable practices has multiple reasons. The primary motivation was necessity of various kinds, as the CEO disclosed to us:

“Necessity, there was a lot of chandi on our premises. So when a pressing person came, we asked what we can do, and he put it through the pressing machine to develop a large block of pressed chandi, much less volume. That we dried and used it alongside firewood. The problem became an invention essentially. Similarly, we anticipated water shortage might be a problem in future. So we discussed about the sewage treatment plant; even toilet water can be made bacteria free for reuse. So it was a necessity.”

The other motivation was adherence to certification and stakeholder expectations. For instance, SSANH adheres to the ISO certification and good manufacturing practice (GMP) guidelines in the manufacturing process. A large proportion of the manufacturing plant employees are recruited and trained from the local community itself. Naturally, they are keen to prevent any environmental pollution or foul smell in the community.

Dr Ratnam feels that the waste produced after therapies cannot be recycled for reuse as therapeutants. The waste includes oils and pastes used for therapies. However, the organization reuses the oil effectively.

“We use the oil that is used for treatments as fuel in the incinerator at our hospital to burn the waste produced after treatments.”

Like Pankajakasthuri, SSANH reuses the waste produced while manufacturing medicines as manure.

“The chandhi (waste materials) produced while manufacturing kashayams (a type of ayurvedic medicine) and other medicines is used as manure by farms.”

They have even found a way to reuse the waste produced in their canteen.

“Now the waste from our canteen is regularly collected by a pig farm and used for feeding pigs.”

SSANH does not recycle the waste materials produced during treatments, but they have found novel ways of reusing the waste productively.

Insert Table 1 about here

5. Discussion and Conclusions

This paper discusses the adoption of CE practices in SMEs in an emerging market context. Its primary concerns are twofold: the extent to which SMEs in emerging countries contribute to CE adoption and practices and, secondly, the nature of this involvement in CE. To answer these questions, we have, as a first step, performed a bibliometric review of CE research to develop a descriptive discourse on the knowledge structure of the research field. Next, we have presented a specific discourse on CE in SMEs in an emerging country context. Subsequently, in step two, data was collected and analyzed from the two organizations selected from an indigenous industry, namely the Ayurveda industry, thereby substantiating and complementing step one’s descriptive discourses.

Among the contemporary research themes that we confirm through our analysis is the notion that CE research offers a promising contribution to sustainable development and is aligned with desirable economic, environmental, and political priorities (Bassi et al., 2020). Perhaps the extant degree of heterogeneity in CE research can be attributed to the various interests of stakeholders across industries, geopolitical boundaries, types of institutions, and establishments. We establish and confirm that, in the main, discussion of the role of CE has been focused on large organizations and developed economies, leading to some generalized understanding of CE practices through step one, the bibliometric review of CE research. Based on this analysis, we have

identified a list of CE practices based on the CE model's fundamental principles (restoration and regeneration). For example, the practises include co-creation (Boldrini, 2018), energy recovery (Škrinjarić, 2020), smart waste management (Veleva & Bodkin, 2018), reuse (Barreiro-Gen & Lozano, 2020), recycling (Barreiro-Gen & Lozano, 2020), repair (Ghisellini & Ulgiati, 2020), resource recovery (Cong, Zhao, & Sutherland, 2017), and resource efficiency (Rahman & Kim, 2020). Other initiatives include green supply chain management, green purchasing, anaerobic digestion, and waste-to-energy processing (Hussain Mishra, & Vanacore, 2020) for promotion of economic and environmental goals. These are some of the key insights emerging from our study.

In the context of European Union SMEs, Bassi and Dias (2020: 2530) have observed that “the big industries’ knowledge of CE has not been spread sufficiently to SMEs”. Our quantitative literature review confirms and substantiates this contention while also confirming that CE research in emerging countries’ SMEs has attracted limited scholarly attention. That is, this research is still in a nascent stage (Ünal et al., 2019). Some SME-focused research discusses waste management practice and compliance in SMEs’ adoption of CE practices (Woodard, 2021), and the positive effect of CE practice on the environmental and economic performance of a traditional business in an emerging country context (Susanty et al., 2020), and challenges posed by adoption of CE practices in linear production establishments (Trigkas, Karagouni, Mpyrou & Papadopoulos, 2020). Some scholars have also endeavoured to identify SMEs’ attitudes toward adoption of CE practices; these concerns have been grouped into material provision, resources’ re-utilization, and financial advantage categories (Ormazabal, Prieto-Sandoval, Puga-Leal, & Jaca, 2018). The collection of these advances in knowledge has enabled us to contribute novel oversight of the role of CE in SMEs in emerging countries.

5.1 Theoretical Implications

The extant literature provides scant evidence relating to CE practices in SMEs despite a drastic increase in the research output on this topic (Holzer, Rauter, Fleiß & Stern, 2021). For instance, there is limited empirical evidence regarding SMEs' waste management practices, which is crucial for the CE, and there is an urgent need to plug this gap (Woodard, 2021). Compared to larger organizations, SMEs are more agile, adaptive, and innovative and, hence, they can contribute significantly to the implementation of the CE. Reducing costs, mainly by consuming fewer raw material, increases the value capture in SMEs (D'Amato, Veijonaho, & Toppinen, 2020). Recent empirical evidence suggests that SMEs can help nations promote the CE with the help of technology and innovation (Hussain et al., 2020). SMEs contribute significantly towards the development of a sustainable economy, which is also crucial for their long-term survival (Oncioiu et al., 2018).

Through our robust literature review section, we have conducted an extensive scientific and bibliometric analysis of the extant literature on CE and identified the major themes. We contribute to the literature by developing a strategic diagram presented in Figure 1 that encompasses the CE domain's major research themes. A detailed examination of these themes led us to conclude that some of them are under-researched. We critically identify through our study how emerging market firms face many challenges while adopting CE practices. Further, our examination, through step one, reveals that many large organizations in emerging markets have achieved high CE performance levels despite the challenges they face. We also identify how, in contrast, emerging-market SMEs lag behind their counterparts in developed countries in practicing CE. However, we further identify how the Ayurveda industry, whose very existence is based on holistic and sustainable practices, differs from other SMEs by emphasizing CE practices. Hence, we focused on the Ayurveda industry in our study. Thus, due to its unique contextual and

theoretical focus, our study makes a significant contribution to the CE literature. Additionally, we would like to add here that the Ayurveda industries are essentially representative of their sector, as when it seems necessary, they apply their sustainable practices in a more aware way than is the case in other SMEs.

We reiterate that we have used bibliometric analysis alongside a case study methodology for conducting this research. Hence, ours is one of the few studies that have enhanced precision and robustness by use of a mixed-method approach, one still under-utilized by researchers (Gibson, 2017). As has been argued and confirmed through our study, the mixed-method approach helps researchers to uncover critical phenomena that cannot be generally uncovered through other approaches (Clark & Creswell, 2008). In fact, some researchers suggest that mixed-method research could be a third paradigm between quantitative and qualitative research methods (Johnson & Onwuegbuzie, 2004). In closing, we state that the deliberate choice of a mixed-method approach for our research was useful, as our study could dive deep into CE's intricacies, making a significant contribution to this literature stream.

5.2 Practical Implications

SMEs contribute significantly to the economic growth of countries and create many jobs, but SME involvement in the CE – with the exception of many SMEs devoted to indigenous industries – is minimal (Klewitz & Hansen, 2014). Though neoclassical economic theories give little emphasis to material reduction (Lieder & Rashid, 2016), the CE can provide economic benefits to the stakeholders (Geissdoerfer, Savaget, Bocken & Hultink, 2017). The CE paradigm assigns

importance to both economy and environment and attempts to replace the linear flow of products and materials with a circular flow (Geng & Doberstein, 2008; Webster, 2017).

From the case study analysis, we draw on two key discussion points. First, our findings from the two case studies confirm the involvement of indigenous businesses in adopting CE practices. We identify CE practices such as reusing, reducing, revamping, revising, and recycling (figure 2). These practices are consistent with CE practices identified in the literature (Boldrini, 2018; Škrinjarić, 2020; Barreiro-Gen & Lozano, 2020; Cong et al., 2017). These findings confirm the participation of SMEs from the indigenous industry in the adoption of CE practices. It is also important to note that, for indigenous industries, the adoption of some CE practices as part of their manufacturing process came naturally. For instance, herbs and plant-based raw materials in the Ayurvedic industry meant that the waste produced could be readily recycled for use as agriculture manure. Second, we identify the role of technology and mechanization in supporting CE practices within traditional indigenous industries like Ayurveda. The guiding principles of the Ayurveda industry are based on ancient Indian Vedic scriptures, which date back to the BCE era. However, we identify that SMEs can integrate those guiding principles with modern technology to experiment with new approaches, such as CE practices. For example, as discussed earlier, Pankajakasthuri has used tunnel-dryer technology to produce medicine with reduced resource use and time. SSANH has reduced the consumption of the herbs needed to manufacture medicines through mechanization. This adds to the emerging discussion on technology's potential role in enabling the CE (Garmulewicz, Holweg, Veldhuis, & Yang, 2018; Nascimento et al., 2019) and the role of technological innovation in indigenous industries (Chatterjee & Sahasranamam, 2018).

5.3 Future Research Directions

In the previous sections, we have discussed the advancement of CE research over the years. However, the primary focus of CE research has been large organizations. We have highlighted the need for extensive research on the role played by SMEs in CE. SMEs have unexplored potential to make significant contributions towards CE. In addition, emerging market SMEs deserve more focused attention due to their distinctive characteristics. Hence we urge researchers to examine critical research questions that would deep-dive into the CE practices in SMEs.

To conclude, our research is amongst the earliest to explore CE practices among SMEs in indigenous industries. We find that the SMEs in indigenous industries play a pioneering role in adopting CE practices following a 5Rs approach. We also find that SMEs integrate the traditional practices of the indigenous industry with modern technology to develop CE practices. Qualitative research offers limited scope for generalization. Our study opens up an important avenue for future research in studying indigenous industries like Ayurveda. It offers opportunities to build on reverse innovation research and understand the scope for translation of CE practices from SMEs and indigenous industries to large MNCs. The findings of this study can be extended to other countries and contexts. For example, similar industries like acupuncture, yoga therapy, homeopathy, naturopathy, Siddha, cupping therapy, and Unani are practiced in many countries. In addition, almost all countries have their own traditional treatment methods. The insights we have shared through this study will be of immense use in promoting CE practices in these industries.

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Table 1: A Comparative Summary table

CE principles	Pankajakasthuri case	Sree Subramanya Ayurvedic Nursing Home
Reuse	Septic water treatment plant, for reusing water for cleaning of raw materials	Reusing the oil as fuel in the incinerator; Reusing the food waste to feed pigs.
Reduce	Modern technology in agriculture allows for standardization in processes, the volume of raw materials used for chemical formulations manufacturing is reduced without compromising the efficacy and quality of medicine.	Redeployment of the workforce and multitasking; Mechanization of the manufacturing processes; Using locally available materials.
Recycle	The waste created at the end (called <i>chandhi</i>) is pressed and dried, and used in the manufacturing process itself as fuel for the thermal heating process. It was earlier processed and sold as manure too.	Chandhi (waste materials) produced while manufacturing medicines used as manure.
Revamp	Developed proprietary tunnel drying technology that allows for processing of medicine with less quantity material and in a shorter time	Replaced firewood with cooking gas for manufacturing medicines; Fixed ceramic tiles on the walls to reduce the frequency of painting.
Revise	They transitioned from traditional Ayurvedic medicine preparation approaches using firewood heating to thermal fluid heating, which is efficient in heat usage. Also, for employees, there is no smoke and can operate the machine nearby. These processes adhere to GMP and ISO standards and follow a standard operating procedure.	Mechanization of the manufacturing processes.

Figure 1: Strategic diagram of the CE research field

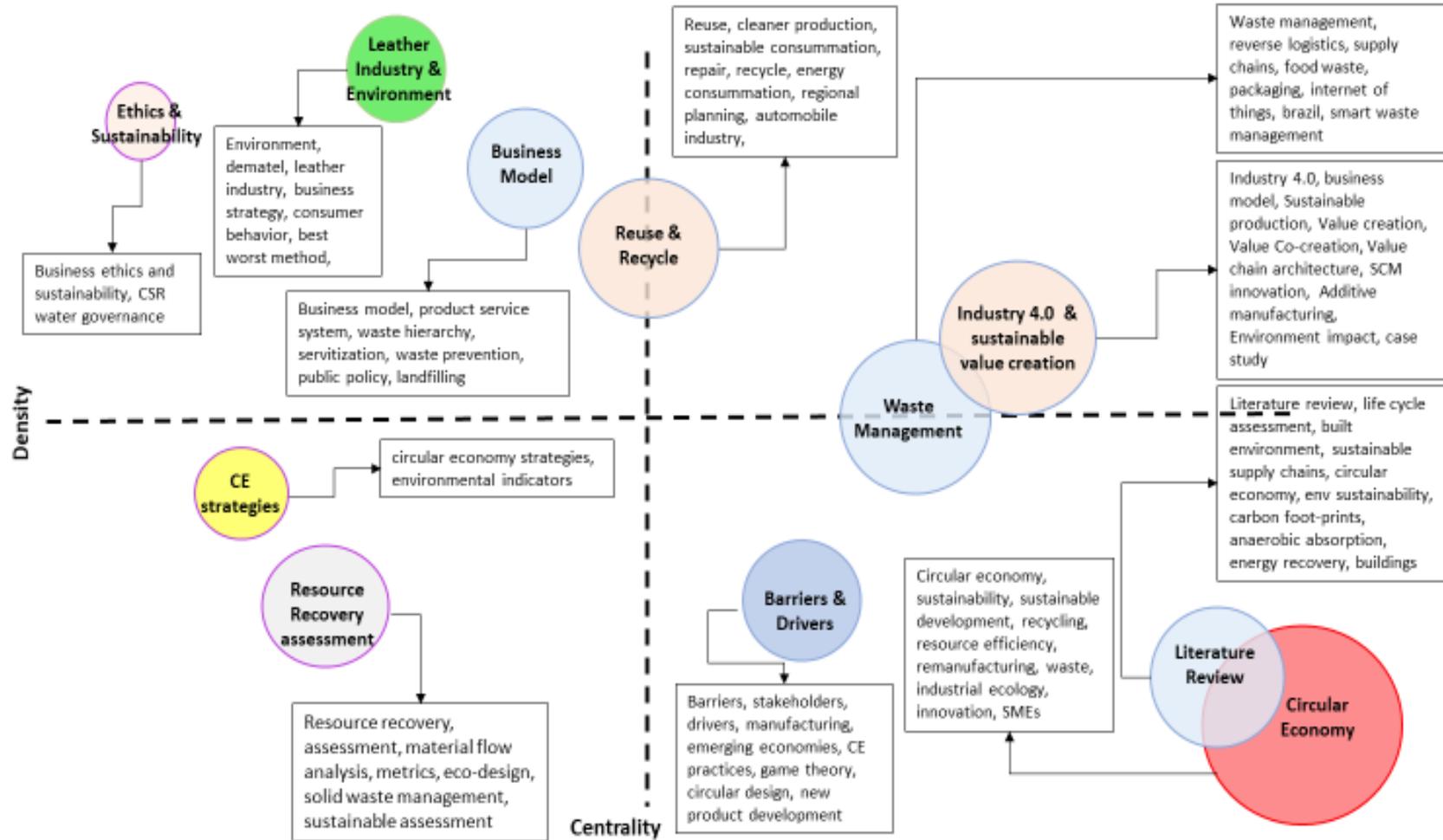


Figure 2: Circular Economy Practices in the Indian Ayurveda SMEs

