Unveiling the Influence of Sustainability Control Systems on the Adoption of Circular Economy Business Models: A Mixed Method Approach

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Abstract

Inspired by the limitations on the impact of sustainability controls on Circular Economy Business Models (CEBM), this research seeks to evaluate the effects of Sustainability Control Systems (SCS) on CEBM. This study employed an explanatory sequential mixed-methods approach in two phases, focusing on manufacturing companies in Sri Lanka. Data collected via a survey were analyzed using descriptive and inferential statistics in the quantitative phase, and semi-structured interviews were analyzed using thematic analysis in the qualitative phase. The results indicate that while the adoption rate of SCS is high, most companies have not yet aligned with the phases of a circular economy. Therefore, CEBM adoption remains insufficient in Sri Lankan manufacturing companies, and SCS shows no significant impact on CEBM adoption. The take-transform phase is predominantly embraced by firms when adopting the circular economy, while the use phase is the least adopted. While companies' sustainability control systems are closely aligned with their primary business operations, there is a noticeable lack of emphasis on Circular Economy objectives. Organizations are found to engage in CE activities unintentionally, viewing them as components of a broader sustainable strategy. Moreover, these companies often mimic competitors in adopting sustainability practices without acknowledging the need to adjust sustainability systems to enable sustainable operations. Policymakers, professional bodies, and academic institutions should collaborate to create an enabling environment that fosters corporate adoption and integration of circular economy business models in developing economies.

Keywords: Business models, circular economy, manufacturing, mixed method, Sri Lanka, sustainability controls

Introduction

Traditional business practices, characterized by the "take, make, and dispose" model, have led to substantial environmental damage and resource waste in their pursuit of financial growth and value (Ünal et al., 2019). In order to overcome the shortcomings of traditional business practices, scholars advocate for the adoption of innovative business models such as the Circular Economy (CE) (Kennedy & Linnenluecke, 2022) to advance sustainable development (Carraresi & Bröring, 2021; Centobelli et al., 2020; Urbinati et al., Chiaroni, & Chiesa, 2017). The CE, as an emerging sustainability strategy (Nyam, Ayeleru, Ramatsa, & Olubambi, 2024), holds promise in maximizing resource utilization (Kuzma & Sehnem, 2023) and minimizing waste (Johansson & Henriksson, 2020; Svensson & Funck, 2019). Circular Economy Business

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Models (CEBM) describe how businesses create value through CE strategies, such as cleaner production or sustainable solutions (Antonioli et al., 2022), within the CE framework (Ghisellini et al., 2016). As such, CEBM is known as a strategy for capitalizing on CE business structures and integrating operations into the business model (Asgari & Asgari, 2021; Mallick et al., 2023; Stahel, 2016).

Despite the growing literature on the CE, the strategic implementation of CEBM remains largely unexplored. While empirical evidence demonstrates the utility of sustainability systems in facilitating the implementation of specific strategies such as CSR and safety (Arjali`es and Mundy, 2013; Wijesinghe et al., 2023), there is limited understanding of their usefulness in implementing CEBM for organizational sustainability. This is an important consideration, as in the business strategy literature, many scholars underscore the need to align business models and sustainability systems when organizations pursue a particular strategy (Aaltola, 2018; Ruiter, De Feijter, & Wagensveld, 2022). Since sustainability systems provide mechanisms for managers to ensure that resources are gathered (Bhuiyan, Baird, & Munir, 2022) and utilized effectively and efficiently to fulfill the organization's goals (Simons, 2019), they are essential to CEBM implementation. They ensure the monitoring and controlling of resource consumption (Fatimah, Govindan, Sasongko, & Hasibuan, 2024; Seles et al., 2022), adherence to circularity principles, provision of practical tools and metrics to assess CE initiatives, and mitigation of risks associated with CE initiatives (Ruiter et al., 2022). Additionally, sustainability systems appropriately drive employee behavior so that decisions and actions align with the organization's goals and CE strategy (Bisbe & Otley, 2004). Additionally, research has demonstrated that sustainability systems are essential to the creation and implementation of comprehensive, sustainable environmental plans, policies, and programs such as CE (Epstein & Roy, 2003; Perego & Hartmann, 2009).

Despite the importance of sustainability systems for CEBM, there is a paucity of studies that explore how sustainability control systems affect their adoption. Additionally, only a few studies have examined the current state of CE adoption, the surrounding environment, and the opportunities, challenges, and realities of implementing CE in developing nations (Kirchherr et al., 2023). Against this backdrop, this paper examines the degree of adoption of CEBM and sustainability controls in Sri Lankan manufacturing companies and explores how sustainability control systems influence CEBM adoption in developing countries, using a mixed-methods approach and Sri Lanka as the study setting.

Choosing Sri Lanka as the study context is significant as developing nations play a crucial role in achieving sustainable development, but often lag in adopting CE practices compared to developed countries (Ahmed, Mahmud, & Acet, 2022). Despite being a relatively new concept in Sri Lanka, many organizations have expressed interest in integrating CE principles into their operations to reduce waste (Agrawal et al., 2021) and environmental impact (Bekchanov & Mirzabaev, 2018). Moreover, Gunarathne et al. (2021) emphasize that, to enhance organizational sustainability performance, top enterprises in Sri Lanka have an urgent need to adhere to environmental management and CE principles. However, concerns persist about

integrating CE principles into business operations in Sri Lanka, making it an intriguing setting to explore the impact of sustainability on CEBM adoption.

In exploring new research areas such as CE and CEBM, researchers should use all available approaches to understand the problem, without focusing solely on a single paradigm (Aguilera et al., 2021; Creswell & Hirose, 2019). This means that the limitations of one approach will be offset by the advantages of the other approach when both quantitative and qualitative data are used. Furthermore, this method widens and deepens the researcher's understanding of a research problem. Qualitative data is required to understand better statistical results (Creswell & Hirose, 2019) and to provide context, nuance, and understanding of statistical links. Thus, to address the research problem comprehensively, a mixed-method approach is employed.

This study makes several important contributions to the extant literature: First, it empirically highlights how organizations can strategically use sustainability controls to implement their CEBM strategies. This is important, as scholars highlight the possibility of utilizing sustainability control systems to play an important role in sustainable business model innovations such as CEBM (Antonioli, Ghisetti, Mazzanti, & Nicolli, 2022a; Jabbour & Santos, 2008; Kalmykova, Sadagopan, & Rosado, 2018; Ormazabal et al., 2016). Second, this study extends Simons' (1995) levers of control framework to explore the use of sustainability controls in the context of CE. In doing so, it develops the concept of SCS (see Section 2.2). Hence, the present study adds to the growing body of research that uses sustainability control frameworks to investigate the relationship between organizational controls and sustainable practices (Gunarathne et al., 2021; Wijesinghe et al., 2023). Third, this research contributes to methodological approaches to the study of CEBM by employing a mixed-methods (‘explanatory sequential method’) approach, which provides a rich account of the attendant intricacies and nuances when organizational control systems are involved in CEBM adoption.

The rest of the paper is organized as follows: Section Two surveys the literature relating to the study by synthesizing two areas: CEBM and sustainability control systems. Section Three presents the study’s methodology, followed by the findings in the next section. Section Five presents the discussion, and the last section contains the conclusion.

Literature Review and Hypothesis Development

Circular Economy Business Model (CEBM)

The CE has the potential to catalyze transformations in traditional business models (Pereira et al., 2022). According to published work (Vallet-Bellmunt et al., 2023), Compass (Tsalis, Stefanakis, & Nikolaou, 2022), indices, and phases (He & Mai, 2021) have all been used to examine the degree of CEBM implementation. *Take-transform*, *use*, and *recovery* are the three main phases of CEBM adoption, which entail moving from the linear "take, make, use" model to the circular "take, make, use, and recover" model (Elisha, 2020; Dieleman et al., 2019). According to Tsalis et al. (2022), these three phases, introduced by Ormazabal et al. (2018), provide a solid framework for CEBM, aid in alignment with the Sustainable Development Goals (SDGs), and help to strengthen the link between business model innovation and CE (He

& Mai, 2021). Most importantly, these phases can be implemented concurrently, without waiting for the maturation of others (Olaizola et al., 2020).

The "take-transform phase" underscores the importance of maximizing the responsible and efficient use of biological and technical resources (Dieleman et al., 2019; Ormazabal et al., 2016). It promotes selecting suppliers and materials with an environmental focus (Haleem et al., 2021). By using circular or biodegradable materials, such as polyester and glass, that can be reused across many value chains (Poponi, Arcese, Ruggieri, & Pacchera, 2023), businesses can improve their environmental performance and minimize pollution (Ormazabal et al., 2016). During the "use phase," businesses utilize CEBM to prolong product lifecycles by providing maintenance or after-sales services and educating customers on how to use products for extended periods (Diez-Cañamero & Mendoza, 2023). In addition, this stage entails implementing green marketing tactics, segmenting the market, offering product-service systems, and informing customers and end users about eco-labeling and zero-waste certification, among other green features (Saha, Dey, & Papagiannaki, 2022).

According to Dieleman et al. (2019) and Ormazabal et al. (2016), the "recovery phase" emphasizes using waste heat, reusing industrial waste, obtaining used goods from customers, and selling byproducts generated in company processes. Moreover, Ormazabal et al. (2016) note that companies in industries such as construction, mechanical, electrical, and perishable goods sometimes encounter difficulties creating an intense recovery phase of the CE, especially if they do not have control over the final product. To reduce resource consumption and adverse environmental impacts, sustainability-focused controls must be strengthened to implement CEBM effectively.

Sustainability Control Systems (SCS)

Sustainability management controls represent a distinct subset of management controls focused on environmental and social issues (Burritt & Saka, 2006; Gond et al., 2012; Johnstone, 2019). Without the gathering, analysis, and management of sustainability data and goals, businesses cannot effectively pursue strategies such as CE (Bebbington et al., 2017; Bebbington & Unerman, 2018; Crutzen & Herzig, 2013). Consequently, sustainability controls become pivotal in determining the success of CE strategic implementations (Wijethilake, Munir, and Appuhami, 2017). Moreover, organizations need to apply sustainability controls to achieve the strategic objectives of their circularity initiatives. Therefore, this study proposes the concept of sustainability control systems (SCS) as the management control system to be implemented in organizations following CE strategies.

The literature argues that a combination of sustainability controls has a more significant impact on sustainable strategy implementation than individual controls alone (Gschwantner & Hiebl, 2016). The levers of control framework developed by Simons (1995) offers a comprehensive understanding of sustainability management control in businesses, treating the system as a whole rather than as a collection of individual controls. This framework discusses the role of

management control in executing emergent strategies, such as CE, and in responding to emerging opportunities and strategic uncertainties associated with CEBM (Ruiter et al., 2022). According to Simons (1995), control of business strategy, such as CEBM, is achieved by integrating four constructs from the levers of control framework. They are (see Section 3.2 for more details of these constructs):

- 'Diagnostic control systems' reward employees appropriately, track their performance, and motivate them to ensure they are motivated to fulfill company goals.
- 'Interactive controls' encourage discovery and learning, allowing new tactics to evolve as players throughout the organization respond to perceived possibilities and hazards.
- 'Belief systems' publicly share and reaffirm to provide the corporation with its fundamental values, direction, and goals.
- 'Boundary systems' prevent undesirable conduct and lower organizational risk by designating the space in which organization members can operate.

Effective administration of a CE strategy requires balancing the multiple uses of sustainability control systems, which is essential to any strategy's success (Arjaliès & Mundy, 2013; Widener, Gliedt & Tziganuk, 2016). The levers of control framework is utilized in this study for several reasons. First, it focuses primarily on using sustainability control systems to drive strategy renewal, supporting both mainstream and sustainable strategies (Abernethy & Brownell, 1999; Arjaliès & Mundy, 2013; Bruining, Bonnet, & Wright, 2004; Kober, Ng, & Paul, 2007). Through the creation of a CE, managers utilize sustainability control systems to support the renewal of mainstream company strategy and to manage sustainable strategy (Arjaliès & Mundy, 2013). Second, it emphasizes managers' responsibility to ensure the successful implementation of the desired strategies while remaining receptive to strategies emerging from other business units (Abernethy & Brownell, 1999; Kober et al., 2007). Third, it offers an analytical tool for examining how managers confront strategic uncertainty through management control systems (Simons, 1995). This is important because adopting a CEBM inevitably creates strategic ambiguity, which presents new risks and opportunities for the business (Schaltegger et al., 2015). A further illustration of the applicability of the levers of control framework in solving CE issues is the conceptualization of sustainability control systems, which yield varying degrees of integration of sustainability within the organizational strategy (George et al., 2016). To put it briefly, the levers of control framework's emphasis is on the multifaceted applications of management control systems aimed at illuminating how SCS influence sustainable strategy.

Hypotheses Development

As per Simons (1995), in the levers of control framework, diagnostic control systems are formal feedback mechanisms utilized to monitor organizational outcomes and correct deviations from pre-set performance standards (Langfield-Smith, 1997). They play a crucial role in implementing intended strategies to ensure the predictable achievement of goals (Simons, 1994). Simons (2000) outlines two primary justifications for employing diagnostic control systems: first, to execute strategies efficiently, and second, to conserve limited

managerial time. This is because making decisions that align with the organization's objectives and strategy can be challenging (Simons, 1995).

Diagnostic control systems scrutinize whether the current strategy aligns with business innovations such as CEBM (Parida, Burström, Visnjic, & Wincent, 2019). Conversely, within diagnostic controls, managers must personally establish and negotiate goals with subordinates to ensure the organization achieves its strategic innovations (Simons, 1995). Evaluating these goals against predetermined criteria is deemed necessary to advance the implementation of the CEBM strategy. Diagnostic controls suggest that the final step focuses on validating and executing a CEBM that aligns with overarching objectives related to financial, environmental, and social benefits (Parida et al., 2019). Consequently, in line with the above arguments, the following hypotheses were formulated.

H_1: Diagnostic control systems have a positive influence on CEBM adoption.

According to Simons (1995), managers can cultivate innovation within the company through interactive control systems. These systems are defined as "formal systems used by top managers to regularly and personally involve themselves in subordinate decision-making activities" (Simons, 1994, p.17). Organizations are advised to maintain flexibility in the face of significant unexpected disruptions in the external environment. Consequently, strategic uncertainties —various factors and situations that may invalidate an organization's current strategy —form the basis for interactive control systems (Simons, 1995).

Simons (1995) suggests that an organization's top management can explore novel projects such as CEBM through interactive control systems. These mechanisms describe how senior management encourages employees to generate new ideas in the CE and to effectively implement them (de Padua et al., 2019). Such bottom-up, interactive control systems facilitate creative problem-solving and are crucial in adopting CEBM (Persis et al., 2021). Thus, the following hypothesis was formulated.

H_2: Interactive control systems have a positive influence on CEBM adoption.

Both planned and spontaneous strategies can be influenced by belief systems (Simons, 2000). Belief systems are described as "the explicit set of organizational definitions that senior managers communicate formally and reaffirm regularly to provide the organization’s basic values, purpose, and direction" (Simons, 1995, p. 12). They clarify for company members how the company generates value and what standard of performance is expected of them. Belief systems can help individuals within an organization understand which actions to take and where to seek guidance when issues arise with strategy control. Organizations often reassess their business models to align them with the CE strategy. Parida et al. (2019) assert that the transition to a CEBM occurs in response to an updated strategy. An organization's successful shift to a CEBM is supported by a strong vision of sustainability strategy and circular principles, in particular. Therefore, Urbinati et al. (2017) emphasize that a clear vision is essential for the transformation process. Persis et al. (2021) argue that the success of adopting a CEBM hinges solely on individual contributions, which can be influenced by vision. Accordingly, the following hypothesis was formulated.

H_3: Belief systems have a positive influence on the CEBM adoption.

Boundary systems are tools organizations use to communicate to their members the behavior condoned by upper management (Simons, 1995). According to Simons (1994), they are "formal systems used by top managers to establish explicit limits and rules which must be respected" (Simons, 1994, p.17). Top management employs these systems to ensure that actions deemed too risky or not aligned with the strategic direction are not utilized to implement the realized strategy (Simons, 1995; 2000). Boundary systems, therefore, delineate the limits on the types of actions that belief systems promote. Their significance is underscored by the fact that businesses cannot rely solely on laws and regulations, as compliance with those requirements alone may not shield companies from actions that could result in financial loss or even bankruptcy (Arjaliès & Mundy, 2013).

Boundary controls prevent individual actions that are detrimental to the strategic decision of sustainability (Arjaliès & Mundy, 2013). In other words, boundary systems ensure that CEBM aligns with the corporation's strategy and objectives (Arjaliès & Mundy, 2013). However, these boundaries are not fixed but evolve as organizations seek innovative solutions (Barros & Ferreira, 2023). Existing literature has also highlighted the importance of business model boundaries. According to Arjaliès and Mundy (2013), reckless actions by individuals could expose a business to unacceptably high risks, jeopardizing the company's reputation. Hence, boundary systems play a significant role in business model transformation such as the adoption of CEBM. Considering this argument, the following hypothesis was formulated.

H_4: Boundary systems have a positive influence on CEBM adoption.

According to Simons (1995), control of business strategy is achieved through the integration of four constructs of the levers of control framework. The literature suggests that management control systems should be tailored to align with the organization's business strategy (Macintosh & Daft, 2019; Otley, Broadbent, & Berry, 1995; Simons, 1995). Business models are intrinsically linked to strategy, and evolving strategy is intertwined with innovation in business models (Hultberg & Pal, 2021). Another definition of a CE is a sustainable development plan aimed at addressing pressing issues such as resource scarcity and environmental degradation (Heshmati, Abolhosseini, & Altmann, 2015). Therefore, when an organization adopts a CE strategy, its business model must change, necessitating modifications to its management control systems. Based on this rationale, this study examined the relationship between SCS in totality and the CEBM. In this light, the following hypothesis was developed.

H_5: SCS has an impact on CEBM adoption.

Based on the preceding hypotheses, the study's conceptual framework was established as shown in Figure 1.

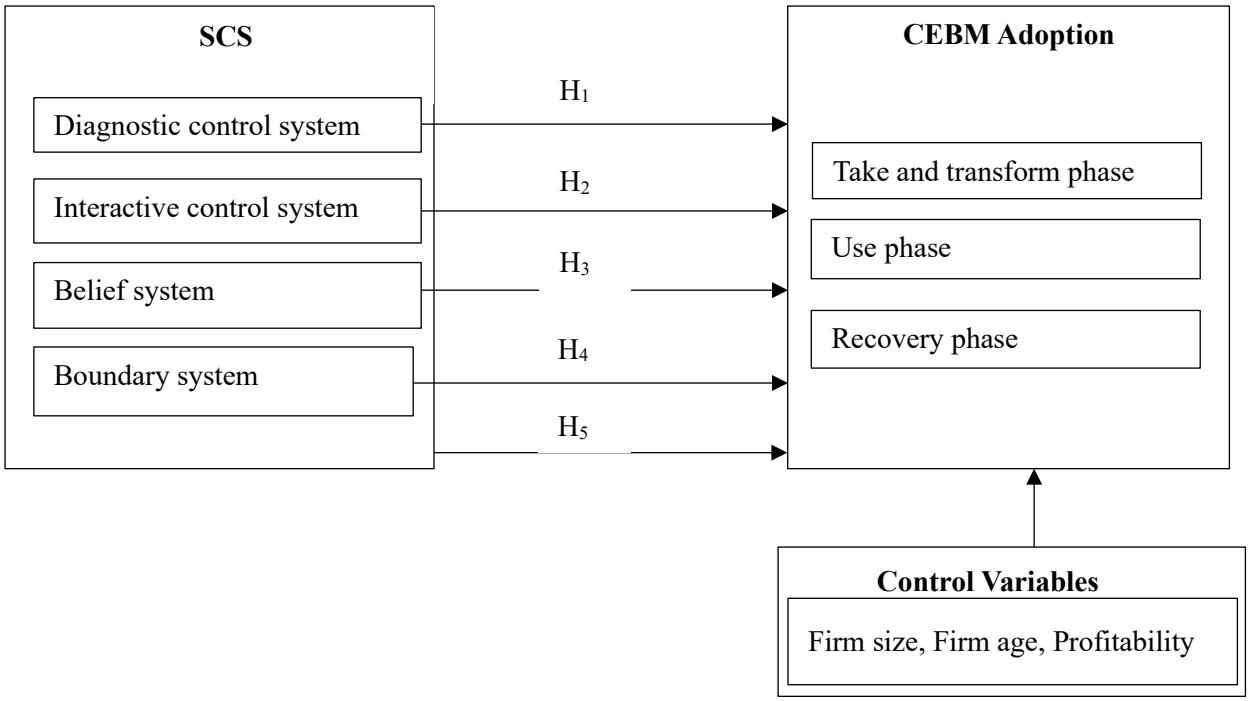

Figure 1: Conceptual Framework

Methodology

Study Design

The current study aims to identify the extent of CEBM implementation and SCS adoption and to examine how SCS adoption affects CEBM implementation. While the goals mentioned can be pursued using quantitative research methods, this approach might not fully capture the reasons underlying the observed statistical relationships (Timans et al., 2019). Nevertheless, the outcomes of the quantitative phase can be enriched and extended by integrating qualitative information, resulting in a more nuanced understanding of the findings (Creswell & Hirose, 2019). Aguilera et al. (2021) suggest that a mixed-methods approach yields a more precise and thorough analysis by addressing the 'why' behind the statistical outcomes. Given the study's objective, which is to explore current circumstances and real-world instances of companies' engagement with CEBM, a suitable approach combines positivism and interpretivism. Consequently, this study utilizes a mixed-methods approach, specifically the 'explanatory sequential method' (Creswell & Hirose, 2019).

When qualitative data are required to explain statistical findings—regardless of their significance—the explanatory sequential method appears beneficial (Morgan & Carcioppolo, 2014). This approach entails first gathering and evaluating quantitative data, then gathering and assessing qualitative data. As a result, the methodology uses different stages for qualitative and quantitative data (Ivankova, 2015). Accordingly, in this study, to explore the statistical conclusions drawn from the quantitative data in greater detail, qualitative interview questions were developed. Previous researchers have employed similar approaches to investigate the fundamental causes of acceptance or rejection of specific hypotheses or complexities in sustainability-related studies (Weerasinghe et al., 2023).

Sample

This study's first phase included selecting 137 companies engaged in manufacturing activities that were listed on the Colombo Stock Exchange. As suggested by García-Sánchez et al. (2021), the sample was later reduced to 96 manufacturing firms that have implemented corporate communication strategies related to sustainability via their websites or annual reports. Manufacturing businesses were chosen because they are seen as a sector facing major obstacles in its transition to sustainability (Bhakar et al., 2018) and as having the ability to make a substantial contribution to the CE (Kumar et al., 2019). A questionnaire was used to gather information for the study of the connection between the adoption of CEBM and SCS.

Table 1: Demographic characteristics of respondents and respondents' companies.

Demographic variable	Category	Frequency	Percentage
Respondent profiles			
Gender	Male	41	55.4%
	Female	33	44.6%
Current position of the respondent	Top-level management	5	6.8%
	Middle-level management	23	31.1%
	First-level management	46	62.2%
Company profile			
Annual profit (LKR millions)	Below 1,000	8	10.8%
	1,001 – 5,000	36	48.6%
	5,001 – 10,000	22	29.7%
	10,001 – 15,000	8	10.8%
	Above 15,000	0	0%
Company age (Years)	Below 40	12	16.2%
	41 – 60	11	14.8%
	61- 80	26	35.1%
	81 – 100	21	28.3%
	Above 100	4	5.4%
Company size (LKR billions -Total assets)	Below 100	16	21.6%
	101-500	39	52.7%
	501-1,000	19	25.7%

To avoid the survey being considered spam, it was sent to the selected sample via LinkedIn connections and email, as these methods foster a professional, trustworthy relationship with the survey participants (Ormazabal et al., 2018). Initially, managers within the selected companies with a comprehensive understanding of CE phases and sustainability control systems were identified. The questionnaire was then emailed to these selected personnel. Following multiple rounds of personal follow-ups, 80 responses were received. Six responses were discarded due to incomplete data (refer to Table 1 for more details). The usable response rate for the survey was recorded at 77%.

Semi-structured interviews were used in the study's second phase to elicit interpretations of the regression-based statistical results (Kuo et al., 2019). Two business executives and academic specialists reviewed the comprehensive interview guide used for these interviews (see Appendix I for a condensed version). Furthermore, according to Ertz et al. (2019), factors like believability, transferability, dependability, and conformability were used to evaluate the rigor of the study's second stage. Six interviews were conducted with management personnel who expressed willingness to participate in the second phase of data collection and who were well-versed in SCS and CEBM (see Table 2). The interviews ranged from 40 to 75 minutes, with an average of 1 hour per session. With participants' consent, digital recordings and transcriptions of each interview were created for the study.

Table 2: Summary of the interviews

Interview No.	Position of the respondent	Industry sector	Duration (minutes)
IN 1	Group Finance Director	Material	75
IN 2	Senior Manager – Operations	Capital Goods	55
IN 3	Senior Executive – Operations	Consumer Durable and Apparel	65
IN 4	Senior Manager – Sustainability	Utilities	40
IN 5	Head – Sustainability	Material	45
IN 6	Chief Accountant	Material	60

Measurement of constructs

Following the recommendations of Olaizola et al. (2020), this study measured the degree of adoption of CEBM among Sri Lankan manufacturing companies across the three phases of the CE —take-transform, use, and recovery —suggested by prior scholars (Ormazabal, Sandoval, Leal, & Jaca, 2018). To gather data, the questionnaire developed by Ormazabal et al. (2018) was used, with responses evaluated on a Likert scale. Accordingly, the questionnaire was developed following the guidelines provided by Widener (2007) and Bedford (2015), with a Likert scale utilized for data collection. An overview of the variables included in this study is presented in Table 3.

Table 3: Survey items and measurement of constructs

Variable CEBM	Measurement items	Source/s
Take – transform	• Our company monitors suppliers' compliance with environmental legislation. • When choosing suppliers, our company considers environmental purchasing criteria. • Our company has set environmental standards to reduce energy, water, and raw material consumption during the design and development of its production processes. • Our company's production materials are designed with biodegradability in mind. • The non-biodegradable materials we utilize in our production are intended for recycling, remanufacturing, or reuse.	Ormazabal et al. (2018)
Use	• Our company offers product after-sales services. • Our company offers the product for rent. • Our company offers product maintenance services.	
Recovery	• Our company converts non-recyclable waste materials into energy. • Waste heat is recovered and used as energy by our company. • Our company extends the life of industrial resources such as oils, acids, and lubricants by treating them (e.g., filtration, soaking). • Our business recovers the products our clients no longer need. • Our company sells the industrial materials (by-products) it produces, such as plastics, oils, packaging, and sub-chemicals.	
SCS diagnostic controls	• Our company employs strategies to maintain a regular, consistent schedule for sustainability and CE initiatives. • The sustainability/CE activities of my subordinates are given a regular, frequent agenda by our company through the use of budgets and performance measures. • Our company takes steps to facilitate ongoing discussions and challenges with peers and subordinates over the underlying data, hypotheses, and action plans. • Our company employs strategies to highlight strategic uncertainties —variables that could render the current strategy obsolete or create opportunities for new strategic initiatives.	Widener (2007), Bedford (2015)

	• Our company employs strategies to promote and ease communication and information exchange about sustainability and CE with subordinates.
Belief system	• Our company has formal documents that outline the organization's mission, direction, and sustainability/CE principles. • Our company actively communicates the sustainability and CE key principles to its employees. • Our company commits to the long-term goals of upper management by using formal statements of sustainability/CE values. • Our company uses formal statements of sustainability/CE values to motivate and guide employees as they look for new prospects.
Boundary controls	• It is our company's policy to specify appropriate behavior through its codes of conduct or similar statements. • Specific areas or restrictions on opportunity searches and experimentation are outlined in our company's corporate policies or guidelines. • The top management team of our company actively communicates to subordinates the risks and actions that they should avoid. • Regardless of the outcome, our company penalizes employees who take risks or engage in behavior that violates organizational policy.
Interactive controls	• Our company's operations use metrics to track advancement toward critical performance targets linked to sustainability and CE. • Our company reviews key areas of sustainability/CE performance using budgets and performance metrics. • Our company uses metrics to pinpoint crucial performance factors related to sustainability and CE. • To address deviations from predetermined performance targets, our company employs measures to offer information.

In this study, three control variables were selected: firm size, firm age, and profitability. It is often noted that larger companies tend to attract public attention, which may drive them to adopt CEBM (Manes-Rossi & Nicolo, 2022). Therefore, firm size was measured using total assets. To address the skewed distribution of this variable, a natural logarithm transformation was applied (Kuo, Chiu, Chung, & Yang, 2019). The older the firm, the greater its tendency to adopt a sustainability strategy (Sipola, Saunila, & Ukko, 2023). Over the years, firm age has shown mixed relationships with voluntary adoption of a sustainable business model (Urba, Sinurat, Djailani, & Farera, 2020). Firm age was measured using the years since incorporation (Urba et al., 2020). The variable was logarithmically transformed to account for skewness. Early studies have indicated a link between a firm's profitability and its propensity to adopt voluntary sustainable business models (Bedford, Malmi, & Sandelin, 2016). This is because profitable companies are often better positioned to allocate resources towards sustainable measures. Hence, profitability in the present study was measured using return on assets, calculated as profit before interest and taxes divided by total assets (Urba et al., 2020).

Data analysis

Regression models have been commonly utilized in sustainability literature to examine the influence of SCS on corporate strategy (L. A. Henry, Buyl, & Jansen, 2019). Consistent with this approach, multiple regression analysis was employed in this study to assess the relationship between SCS and CEBM uptake. To choose the best multiple regression method, the Hausman test was employed (Stolzenberg, 2004).

In the second stage of the study, thematic analysis was employed to analyze the interview data (Braun & Clarke, 2016). The transcribed interview data were used to construct initial codes, which were further refined to yield a final set of codes. These codes were then combined to create themes that explain how SCS affects the adoption of CEBM. Aligning with the theoretical underpinnings of thematic analysis (Braun & Clarke, 2016), this study developed themes that shed light on the statistical association between specific diversity features and CEBM adoption. Given the relatively limited attention to SCS in the sustainability literature, qualitative data were incorporated to complement the quantitative findings and underscore their significance (Opferkuch, Caeiro, Salomone, & Ramos, 2022).

Results

Descriptive statistics

The descriptive statistics in Table 4 suggest that the majority of SCS consisted of diagnostic controls ($\bar{x}$ = 4.16), interactive controls ($\bar{x}$ = 4.26), belief systems ($\bar{x}$ = 4.09), and boundary systems ($\bar{x}$ = 4.20). Moreover, many respondents had considered establishing a complete control system ($\bar{x}$ = 4.17) rather than controlling sustainability operations with individual controls.

Table 4: Descriptive statistics

Variable	n	Mean	Standard deviation	Min.	Max.
Diagnostic controls	74	4.16	0.551	3.00	5.00
Interactive controls	74	4.26	0.708	2.00	5.00
Belief systems	74	4.09	0.733	2.00	5.00
Boundary systems	74	4.20	0.724	2.00	5.00
SCS	74	4.17	0.219	2.00	5.00
Take-transform	74	3.77	0.511	3.00	5.00
Use	74	2.55	0.763	2.00	4.00
Recovery	74	3.74	0.631	3.00	5.00
CEBM	74	3.35	0.405	3.00	4.00
Firm size (Rs. Bn) (log)	74	1.58	0.248	1.00	1.88
Firm age (No. of years)	74	6.07	0.993	4.20	8.75
Profitability (%)	74	0.089	0.156	0.74	0.12

According to the interview results, since the companies have paid attention to the SDGs, they are already maintaining SDG-driven sustainability control systems. This has also been reflected in the interviews. In support of this view, respondents stated;

> To achieve the SDGs, we frequently review our control systems. (IN 2)
>
> We see that our competitors align with sustainability trends, and to stay competitive, we also set sustainability key performance indicators (KPIs). A set of controls supports these. (IN 4)
>
> Our teams are evaluating the financial and non-financial impacts of our sustainability activities using pre-set controls for each operational category. (IN 6)

As Table 4 indicates, a significant number of respondents have adopted the take-transform phase ($\bar{x}$ = 3.77) of the CEBM, compared to the use ($\bar{x}$ = 2.55) and recovery ($\bar{x}$ = 3.74) phases. This suggests that the use phase is the least adopted phase of the CEBM among most manufacturing companies in Sri Lanka, and that all practices show a low level of adoption. According to the interview results, the main reason is companies' focus on cost reduction through sustainable production processes and waste management during the take-transform phase. Several respondents expressed their views in support of this fact as follows;

> We try to align most of our production activities to sustainability KPIs. The main reason is that we believe it will lead to significant cost reductions. (IN 2)
>
> We agreed to implement an eco-friendly production system, and this was the first step towards an eco-friendly business model. On the other hand, that is a massive cost saving too. (IN 5)
>
> We have saved a lot by using recycled water in production for years now. However, extending the product's lifetime with a coating incurs a cost to the company. (IN 1)
>
> The use of the product is beyond our control. So, it is not easy to decide which provisions we need for maintenance or after-sales services. (IN 3)

4.2 Statistical analysis with interview results

The regression model was not significant at a 5% significance level, as shown in Table 5. Overall, SCS failed to demonstrate a significant association with CEBM adoption ($p = 0.312$, $p > 0.05$). The qualitative study mentioned above also demonstrates that SCS does not affect the adoption of CEBM.

Table 5: Regression results

	Unstandardized coefficients		Standardized coefficients		
	Beta	Std. Error	Beta	t	Sig.
(Constant)	2.474	0.400		4.943	0.000
Belief system	-0.150	0.138	-0.187	-0.998	0.052
Boundary system	0.011	0.008	0.065	0.208	0.136
Diagnostic controls	0.339	0.209	0.607	1.624	0.130
Interactive controls	0.162	0.119	0.286	1.352	0.209
SCS	0.442	0.523	0.312	1.762	0.058
LogFAge	-0.180	0.166	-0.110	-1.083	0.283
LogFsize	-0.035	0.041	-0.086	-0.859	0.394
Profitability	-0.395	0.270	-0.151	-1.463	0.148

The findings indicate that there is no significant association between belief systems and the adoption of CEBM ($r = -.187$, $p > .05$). In explaining this, the respondents emphasized during the interviews that a belief system is not a facilitator of CEBM adoption. However, companies with a thorough understanding of sustainability can support the implementation of a sustainable business model within an organization. Echoing these sentiments, a respondent stated;

> We have greater awareness of sustainability than CE. Hence, we only consider sustainability in the goal-setting process. (IN 1)

The study's regression analysis revealed no relationship between boundary controls and CEBM adoption ($\beta = 0.65$, $p > 0.05$). The participants also emphasized that boundary controls neither assist nor impede the incorporation of CE into the business model. Companies believe that strict boundaries blunt innovative ideas, which are essential for business model innovation. Moreover, experience is the tool that shapes behavior towards a sustainable business model. In supporting this, respondents stated;

> Boundaries frame people's thinking capacity. It affects productivity. (IN 6)
>
> For example, a long-time employee may know what to do and what not to do due to their expertise. As a result, they produce better resolutions for an eco-friendly business system. (IN 4)

The interactive controls do not indicate a significant impact on CEBM adoption ($r = .286$, $p > .05$). Interviewees stated that the interactive controls of SCS are primarily focused on the primary business activity rather than on sustainability goals. They expressed the following ideas;

> The organization's priorities are set by top-level management, and most of the time, it is profit. So, interactive controls are set to ensure that aspect. (IN 4).
>
> To address uncertainty, implementing sustainability solutions, such as CE, is important. However, profit is key. (IN 5)

Similarly, the regression findings demonstrate that diagnostic control has no impact on the adoption of CEBM ($\beta = .607$, $p > .05$). During the interviews, it was stated that diagnostic controls ensure the organization's main goal achievement and rewards. Sustainability is still not a priority in the goals list of many organizations. Interviewees expressed that;

> Most of our budgets are dedicated to primary business operations, and only slight attention has been given to sustainability KPIs. (IN 6)
>
> Project management systems monitor the output of the departments and divisions. It hardly covers sustainability or any CE aspects. (IN 1)

Discussion

The findings of the current study reveal a heightened level of SCS adoption among Sri Lankan manufacturing firms. This inclination is primarily attributed to the proactive alignment of SDGs with their business models, echoing the insights of Nosratabadi et al. (2019). Motivated by a commitment to sustainable business practices, as evidenced by prior research (Beusch et al., 2022; Ghosh et al., 2019), companies are leveraging SCS to improve their sustainability objectives. Furthermore, these companies have identified the need to move beyond traditional sustainability control systems to achieve sustainability KPIs (Crutzen et al., 2017). Despite the size of the company, to address stakeholder values, most companies tend to work towards sustainability, at least for its symbolic value (De Villiers et al., 2016). However, it is noteworthy that, while SCS are employed to foster sustainable business models, the adoption of CEBM appears less pronounced, a trend not confined to Sri Lanka (Svensson & Funck, 2019).

The results of the current study further reveal that Sri Lankan manufacturing firms have a low level of CEBM implementation. However, this is not exclusive to Sri Lanka. Halog and Anieke (2021) highlight that companies' commitment to adopting CEBM remains low in developing countries. Similarly, Daddi, Ceglia, Bianchi, and de Barcellos (2019) and Kumar et al. (2019) note that many manufacturing firms are at a rudimentary stage in adopting CEBM. Even large firms show a minimum commitment toward CE (Romero-Perdomo et al., 2023). This can be attributable to the lack of solid guidance and experience in CEBM adoption (Virmani, Saxena, & Raut, 2022). Though there is guidance on sustainable value creation through business models, no clear guidance is provided on CEBM adoption. In line with CEBM, companies extend their existing business models rather than develop new, sustainable models (Izzo, Ciaburri, & Tiscini, 2020). Hence, it appears to have more symbolic meaning than significant impact (Delaney et al., 2021). It was also evident that CEBM is embedded in organizations'

sustainability strategies (Gunarathne et al., 2021). Supporting this, Bartie et al. (2021) point out that companies adopting CEBM generally implement a sustainability strategy.

In addition, the degree of CEBM adoption is considerably higher in the take-transform and recovery phases among Sri Lankan manufacturing companies, and the majority of their activities in these phases are addressed through environmental and other sustainability-related laws. Companies adhere to the country's environmental and sustainability-related laws in production and consumption, not only to comply with requirements but also to increase productivity and efficiency in resource use (Prieto-Sandoval, Jaca, & Ormazabal, 2018). The use phase was the least adopted CE phase, and this is because most companies prioritize the production stage over later parts of the supply chain, similar to the findings of Opferkuch et al. (2021)

The statistical analysis of results demonstrated that CEBM strategy uptake is unaffected by SCS. This suggests that the implementation of the sustainable strategy is not significantly impacted by the sustainability control system (Nikolaou & Tsagarakis, 2021). This connection is due to the low level of CEBM adoption. The qualitative analysis of the statistical findings also supported the non-significant link. The findings therefore supported rejecting H5, which states that SCS affects CEBM adoption. According to the interviews, a lack of awareness and exposure, and the absence of a well-established framework to follow are the two main reasons identified for the insignificant impact of SCS on CEBM adoption.
Additionally, the lack of government attention to CEBM promotion can be a reason for non-adoption in the Sri Lankan context. As per Willekes, Wagensveld, and Jonker (2022), insufficient technical knowledge for developing sustainable business models leads to weak strategic innovation. Without having solid guidelines or experience, companies might not know how to link the CE to their sustainability control systems.

The outcomes also revealed that decisions regarding CEBM adoption are unaffected by diagnostic controls. The qualitative investigation lent credence to this conclusion by highlighting that CEBM is not a primary goal of organizations. Similarly, Ryen et al. (2022) stressed the insignificance of diagnostic controls for business model innovation. However, according to Müller-Stewens, Widener, Möller, and Steinmann (2020), diagnostic controls may favorably influence strategic innovations. Nevertheless, diagnostic controls have little influence on Sri Lanka's adoption of CEBM. As a result, H_1 was rejected. According to the interviews, one reason for the insignificant impact of diagnostic controls could be the difficulty in setting targets for adopting CEBM.
Furthermore, diagnostic controls remain ineffective in strategy implementation in the absence of pre-set targets (Willekes et al., 2022). These will complicate monitoring outcomes related to CEBM adoption. Moreover, a lack of experience in broader sustainability makes it difficult for companies to see the bigger picture created by CE. Hence, firms often narrow their focus to the primary operations.

Businesses rarely prioritize implementing sustainable strategies (Conlon, Jayasinghe, & Dasanayake, 2019), and even less so CE within those strategies (Melnychenko & Savenkoa,

2023). Melnychenko and Savenkoa (2023) found that interactive controls have an insignificant effect on sustainability strategy implementation. However, Bradley et al. (2020) found that strategic feedback systems, tracking new ideas, and positioning the organization in the market are significant in implementing strategic innovations. Based on the study's results, H_2 is not supported, and it can be concluded that interactive controls may not have a substantial impact on CEBM adoption. The insignificant impact of interactive controls may stem from individual managers' personal values, which may make them reluctant to assume a sustainability role within an organizational setting. As per the interviews, the lack of interest in the integration of social and environmental initiatives into the business model and the lack of personal discretion (of a manager) on sustainability can contribute to the low level of sustainable business model adoption (Gusmerotti et al., 2019). Furthermore, some researchers show that having top management that does not appreciate the integration of sustainability will discourage sustainable business model innovations (Gusmerotti et al., 2019). As long as organizations do not see CEBM as a solution to strategic uncertainties, they will not adopt interactive controls.

According to the statistical results, a belief system alone is insufficient to enable the incorporation of the CE into the business strategy. As a result, H_3 was rejected. This result conflicts with that of M. Henry et al. (2021), who contend that a strong belief system is more effective at overcoming the challenges of implementing business model innovations. Nonetheless, the adoption of CEBM can be significantly facilitated by additional internal triggers associated with belief systems, such as supportive corporate policies, middle management dedication, funding, rewards, audits, and KPIs (Pavlyuk et al., 2023). Also, raising awareness through vision and mission statements is crucial to the successful implementation of a sustainability strategy (Gusmerotti et al., 2019). This supports the argument that the belief system will prioritize and generate interest in CEBM when there is a dedicated sustainability arm. Not including CE components in the company's belief system symbolizes a downgrade in sustainability.

The study also showed that the adoption of CEBM is unaffected by boundary controls. Companies frequently set loose boundary controls, believing that strict controls will not affect employees' cognitive capacity and will not restrict the generation of sustainability resolutions (Yu, Khan, & Umar, 2022). Additionally, Yu et al. (2022) state that employees with greater field experience contribute significantly to sustainability strategies, as they have a better understanding of the boundaries within which they work. By contrast, Saputra, Tambunan, and Yulianto (2023) suggest that boundary controls are associated with higher rates of sustainability strategy implementation. However, the statistical results of this study do not support H4. As per the interviews, tight boundary controls do not motivate innovative business ideas.
On the other hand, members with slack boundary controls may bring novel initiatives and ideas to approach the CEBM. As per Bedford et al. (2016), the lack of a robust mix of boundary controls within sustainability control systems may explain a firm's lower level of adoption of innovative business strategies; furthermore, awareness and exposure increase over time. Thus, the boundary controls of sustainability control systems, which are not adequately exposed to the CE, may impact the low level of CEBM adoption.

Conclusions

The results of this study indicate a low level of overall CEBM adoption among Sri Lankan manufacturing firms, despite a higher level of SCS adoption. Interestingly, no connection was observed between individual sustainability controls — such as belief systems, boundary controls, interactive controls, diagnostic controls, or the total SCS —and the adoption of CEBM. These quantitative findings were supported by the qualitative investigation, suggesting that the lack of observable association may be attributed to the low degree of CEBM adoption. In light of these findings, the study suggests that while sustainability control systems in companies remain closely aligned with their primary business operations, there is a noticeable absence of significant prioritization of CE objectives, despite engagement in sustainability initiatives. Many organizations seem to adopt sustainability practices merely to imitate competitors, without recognizing the need to adapt sustainability control systems to support sustainable operations. Moreover, CE activities are often undertaken unknowingly, perceived as part of a broader sustainable strategy rather than as a distinct concept within organizational strategies.

These findings provide valuable insights for stakeholders, particularly investors, to assess corporate contributions to a CE. Managers are urged to reconsider corporate contributions to a CE and modify business models to better incorporate a CE, given the limited adoption of CEBM. Training and capacity building at the corporate level may help integrate CEBM effectively into SCS, unlocking its potential and financial rewards. The study calls upon national regulatory and policy-making authorities to establish a corporate agenda for CEBM to promote business involvement within the CE. At the same time, professional organizations can encourage businesses to support CEBM. Additionally, academic institutions are encouraged to update their curricula to include CE, thereby enhancing students' knowledge of CEBM. Collaboration among business organizations, government officials, and academia is deemed essential to promote CEBM in developing countries like Sri Lanka.

Finally, the study's findings should be interpreted in light of its several limitations, which offer potential for future research. First, this study only considered firms that had corporate communication on sustainability. Hence, future research can also consider companies that lack robust corporate communications on sustainability to determine whether these firms exhibit a different magnitude of CEBM or SCS. Second, this study considered the manufacturing companies listed on the Colombo Stock Exchange. Hence, future studies can be conducted across different industries or geographical locations to test the conceptual framework using a larger sample. Third, this study employed data collected from one person per manufacturing firm. However, future studies could consider interviewing several company managers with diverse knowledge of CEBM and SCS. Fourth, this study chose levers of control to quantify SCS. To gain further insight into the relationship between SCS and CEBM adoption, future studies can also consider other sustainability control system structures, such as the sustainability control package introduced by Malmi and Brown (2008). Finally, this study has used Ormazabal et al.'s (2018) three-stage model to gauge the CEBM phases and assess the

degree of adoption. Future studies can consider other approaches investigated in the literature to measure CEBM implementation.

References

Aaltola, P. (2018). Investing in strategic development. *Qualitative Research in Accounting & Management, 15*(2), 206-230. doi:10.1108/QRAM-05-2017-0044

Abernethy, M. A., & Brownell, P. (1999). The role of budgets in organizations facing strategic change: an exploratory study. *Accounting, organizations and society, 24*(3), 189-204.

Agrawal, R., Wankhede, V. A., Kumar, A., & Luthra, S. (2021). Analysing the roadblocks of circular economy adoption in the automobile sector: Reducing waste and environmental perspectives. *Business Strategy and the Environment, 30*(2), 1051-1066. doi:https://doi.org/10.1002/bse.2669

Aguilera, R. V., Aragón-Correa, J. A., Marano, V., & Tashman, P. A. (2021). The corporate governance of environmental sustainability: A review and proposal for more integrated research. *Journal of Management, 47*(6), 1468-1497.

Ahmed, Z., Mahmud, S., & Acet, D. H. (2022). Circular economy model for developing countries: evidence from Bangladesh. *Heliyon, 8*(5), e09530. doi:https://doi.org/10.1016/j.heliyon.2022.e09530

Antonioli, D., Ghisetti, C., Mazzanti, M., & Nicolli, F. (2022a). *The economic returns of circular economy practices*. Retrieved from http://www.jstor.org/stable/resrep39518

Antonioli, D., Ghisetti, C., Mazzanti, M., & Nicolli, F. (2022b). Sustainable production: The economic returns of circular economy practices. *Business Strategy and the Environment, 31*(5), 2603-2617. doi:https://doi.org/10.1002/bse.3046

Arjaliès, D.-L., & Mundy, J. (2013). The use of management control systems to manage CSR strategy: A levers of control perspective. *Management Accounting Research, 24*(4), 284-300.

Asgari, A., & Asgari, R. (2021). How circular economy transforms business models in a transition towards circular ecosystem: the barriers and incentives. *Sustainable Production and Consumption, 28*, 566-579. doi:https://doi.org/10.1016/j.spc.2021.06.020

Barros, R. S., & Ferreira, A. M. D. S. d. C. (2023). Management control systems and innovation: a case study grounded in institutional theory. *Journal of Management Control, 34*(1), 109-133. doi:10.1007/s00187-023-00351-4

Bartie, N., Cobos-Becerra, Y., Fröhling, M., Schlatmann, R., & Reuter, M. (2021). The resources, exergetic and environmental footprint of the silicon photovoltaic circular economy: Assessment and opportunities. *Resources, Conservation and Recycling, 169*, 105516.

Bebbington, J., Russell, S., & Thomson, I. (2017). Accounting and sustainable development: Reflections and propositions. *Critical Perspectives on Accounting, 48*, 21-34.

Bebbington, J., & Unerman, J. (2018). Achieving the United Nations Sustainable Development Goals: an enabling role for accounting research. *Accounting, Auditing & Accountability Journal, 31*(1), 2-24.

Bedford, D. S. (2015). Management control systems across different modes of innovation: Implications for firm performance. *Management Accounting Research, 28*, 12-30.

Bedford, D. S., Malmi, T., & Sandelin, M. (2016). Management control effectiveness and strategy: An empirical analysis of packages and systems. *Accounting, Organizations and Society, 51*, 12-28. doi:https://doi.org/10.1016/j.aos.2016.04.002

Bekchanov, M., & Mirzabaev, A. (2018). Circular economy of composting in Sri Lanka: Opportunities and challenges for reducing waste related pollution and improving soil health. *Journal of Cleaner Production, 202*, 1107-1119. doi:https://doi.org/10.1016/j.jclepro.2018.08.186

Beusch, P., Frisk, J. E., Rosen, M., & Dilla, W. (2022). Management control for sustainability: Towards integrated systems. *Management accounting research, 54*, 100777.

Bhuiyan, F., Baird, K., & Munir, R. (2022). The associations between management control systems, market orientation and CSR use. *Journal of Management Control, 33*(1), 27-79. doi:10.1007/s00187-021-00332-5

Bradley, P., Parry, G., & O'Regan, N. (2020). A framework to explore the functioning and sustainability of business models. *Sustainable Production and Consumption, 21*, 57-77. doi:https://doi.org/10.1016/j.spc.2019.10.007

Braun, V., & Clarke, V. (2016). (Mis) conceptualising themes, thematic analysis, and other problems with Fugard and Potts'(2015) sample-size tool for thematic analysis. *International Journal of social research methodology, 19*(6), 739-743.

Bruining, H., Bonnet, M., & Wright, M. (2004). Management control systems and strategy change in buyouts. *Management Accounting Research, 15*(2), 155-177.

Burritt, R. L., & Saka, C. (2006). Environmental management accounting applications and eco-efficiency: case studies from Japan. *Journal of Cleaner production, 14*(14), 1262-1275.

Carraresi, L., & Bröring, S. (2021). How does business model redesign foster resilience in emerging circular value chains? *Journal of Cleaner Production, 289*. doi:10.1016/j.jclepro.2021.125823

Centobelli, P., Cerchione, R., Chiaroni, D., Del Vecchio, P., & Urbinati, A. (2020). Designing business models in circular economy: A systematic literature review and research agenda. *Business Strategy and the Environment, 29*, 1734-1749. doi:10.1002/bse.2466

Conlon, K., Jayasinghe, R., & Dasanayake, R. (2019). Circular economy: waste-to-wealth, jobs creation, and innovation in the global south. *World Review of Science, Technology and Sustainable Development, 15*(2), 145-159.

Creswell, J. W., & Hirose, M. (2019). Mixed methods and survey research in family medicine and community health. *Family medicine and community health, 7*(2).

Crutzen, N., & Herzig, C. (2013). A review of the empirical research in management control, strategy and sustainability. *Accounting and control for sustainability, 26*, 165-195.

Crutzen, N., Zvezdov, D., & Schaltegger, S. (2017). Sustainability and management control. Exploring and theorizing control patterns in large European firms. *Journal of Cleaner Production, 143*, 1291-1301. doi:https://doi.org/10.1016/j.jclepro.2016.11.135

Daddi, T., Ceglia, D., Bianchi, G., & de Barcellos, M. D. (2019). Paradoxical tensions and corporate sustainability: A focus on circular economy business cases. *Corporate Social Responsibility and Environmental Management, 26*(4), 770-780.

de Padua Pieroni, M., McAloone, T., & Pigosso, D. (2019). *Business model innovation for circular economy: Integrating literature and practice into a conceptual process model.* Paper presented at the Proceedings of the Design Society: International Conference on Engineering Design.

De Villiers, C., Rouse, P., & Kerr, J. (2016). A new conceptual model of influences driving sustainability based on case evidence of the integration of corporate sustainability management control and reporting. *Journal of Cleaner Production, 136*, 78-85.

Delaney, E. L., McKinley, J. M., Megarry, W., Graham, C., Leahy, P. G., Bank, L. C., & Gentry, R. (2021). An integrated geospatial approach for repurposing wind turbine blades. *Resources, Conservation and Recycling, 170*, 105601.

Epstein, M. J., & Roy, M.-J. (2003). Making the business case for sustainability: Linking social and environmental actions to financial performance. *Journal of Corporate Citizenship*(9), 79-96.

Fatimah, Y. A., Govindan, K., Sasongko, N. A., & Hasibuan, Z. A. (2024). The Critical Success Factors for Sustainable Resource Management in Circular Economy: Assessment of Urban Mining Maturity Level. *Journal of Cleaner Production*, 143084. doi:https://doi.org/10.1016/j.jclepro.2024.143084

Ghisellini, P., Cialani, C., & Ulgiati, S. (2016). A review on circular economy: The expected transition to a balanced interplay of environmental and economic systems. *Journal of Cleaner Production, 114*, 11-32. doi:10.1016/j.jclepro.2015.09.007

Ghosh, B., Herzig, C., & Mangena, M. (2019). Controlling for sustainability strategies: findings from research and directions for the future. *Journal of Management Control, 30*(1), 5-24.

Gond, J.-P., Grubnic, S., Herzig, C., & Moon, J. (2012). Configuring management control systems: Theorizing the integration of strategy and sustainability. *Management Accounting Research, 23*(3), 205-223.

Gschwantner, S., & Hiebl, M. R. (2016). Management control systems and organizational ambidexterity. *Journal of Management Control, 27*, 371-404.

Gunarathne, N., Wijayasundara, M., Senaratne, S., Kanchana, P. K., & Cooray, T. (2021). Uncovering corporate disclosure for a circular economy: An analysis of sustainability and integrated reporting by Sri Lankan companies. *Sustainable Production and Consumption, 27*, 787-801.

Gusmerotti, N. M., Testa, F., Corsini, F., Pretner, G., & Iraldo, F. (2019). Drivers and approaches to the circular economy in manufacturing firms. *Journal of Cleaner Production, 230*, 314-327. doi:https://doi.org/10.1016/j.jclepro.2019.05.044

Haleem, A., Khan, S., Luthra, S., Varshney, H., Alam, M., & Khan, M. I. (2021). Supplier evaluation in the context of circular economy: A forward step for resilient business and environment concern. *Business Strategy and the Environment, 30*(4), 2119-2146. doi:https://doi.org/10.1002/bse.2736

Halog, A., & Anieke, S. (2021). A review of circular economy studies in developed countries and its potential adoption in developing countries. *Circular Economy and Sustainability, 1*, 209-230.

Henry, L. A., Buyl, T., & Jansen, R. J. (2019). Leading corporate sustainability: T he role of top management team composition for triple bottom line performance. *Business Strategy and the Environment, 28*(1), 173-184.

Henry, M., Schraven, D., Bocken, N., Frenken, K., Hekkert, M., & Kirchherr, J. (2021). The battle of the buzzwords: A comparative review of the circular economy and the sharing economy concepts. *Environmental innovation and societal transitions, 38*, 1-21.

Heshmati, A., Abolhosseini, S., & Altmann, J. (2015). *The development of renewable energy sources and its significance for the environment*: Springer.

Hultberg, E., & Pal, R. (2021). Lessons on business model scalability for circular economy in the fashion retail value chain: Towards a conceptual model. *Sustainable Production and Consumption, 28*, 686-698. doi:https://doi.org/10.1016/j.spc.2021.06.033

Izzo, M. F., Ciaburri, M., & Tiscini, R. (2020). The challenge of sustainable development goal reporting: The first evidence from Italian listed companies. *Sustainability, 12*(8), 3494.

Jabbour, C., & Santos, F. (2008). Relationships between human resource dimensions and environmental management in companies: Proposal of a model. *Journal of Cleaner Production, 16*, 51-58. doi:10.1016/j.jclepro.2006.07.025

Johansson, N., & Henriksson, M. (2020). Circular economy running in circles? A discourse analysis of shifts in ideas of circularity in Swedish environmental policy. *Sustainable Production and Consumption, 23*, 148-156. doi:https://doi.org/10.1016/j.spc.2020.05.005

Johnstone, L. (2019). Theorising and conceptualising the sustainability control system for effective sustainability management. *Journal of Management Control, 30*(1), 25-64. doi:10.1007/s00187-019-00277-w

Kalmykova, Y., Sadagopan, M., & Rosado, L. (2018). Circular economy – From review of theories and practices to development of implementation tools. *Resources, Conservation and Recycling, 135*, 190-201. doi:https://doi.org/10.1016/j.resconrec.2017.10.034

Kennedy, S., & Linnenluecke, M. K. (2022). Circular economy and resilience: A research agenda. *Business Strategy and the Environment, 31*(6), 2754-2765. doi:https://doi.org/10.1002/bse.3004

Kirchherr, J., Yang, N.-H. N., Schulze-Spüntrup, F., Heerink, M. J., & Hartley, K. (2023). Conceptualizing the Circular Economy (Revisited): An Analysis of 221 Definitions. *Resources, Conservation and Recycling, 194*, 107001.

Kober, R., Ng, J., & Paul, B. J. (2007). The interrelationship between management control mechanisms and strategy. *Management Accounting Research, 18*(4), 425-452.

Kumar, V., Sezersan, I., Garza-Reyes, J. A., Gonzalez, E. D., & Al-Shboul, M. d. A. (2019). Circular economy in the manufacturing sector: benefits, opportunities and barriers. *Management Decision, 57*(4), 1067-1086.

Kuo, T.-C., Chiu, M.-C., Chung, W.-H., & Yang, T.-I. (2019). The circular economy of LCD panel shipping in a packaging logistics system. *Resources, Conservation and Recycling, 149*, 435-444.

Kuzma, E., & Sehnem, S. (2023). Proposition of a structural model for business value creation based on circular business models, innovation, and resource recovery in the pet

industry. *Business Strategy and the Environment, 32*(1), 516-537. doi:https://doi.org/10.1002/bse.3158

Langfield-Smith, K. (1997). Management control systems and strategy: a critical review. *Accounting, organizations and society, 22*(2), 207-232.

Macintosh, N. B., & Daft, R. L. (2019). Management control systems and departmental interdependences: an empirical study *Management Control Theory* (pp. 289-302): Routledge.

Mallick, P. K., Salling, K. B., Pigosso, D. C. A., & McAloone, T. C. (2023). Closing the loop: Establishing reverse logistics for a circular economy, a systematic review. *Journal of Environmental Management, 328*, 117017. doi:https://doi.org/10.1016/j.jenvman.2022.117017

Malmi, T., & Brown, D. (2008). Management control systems as a package--Opportunities, challenges and research directions. *Management accounting research, 19*, 287-300. doi:10.1016/j.mar.2008.09.003

Manes-Rossi, F., & Nicolo', G. (2022). Exploring sustainable development goals reporting practices: From symbolic to substantive approaches—Evidence from the energy sector. *Corporate Social Responsibility and Environmental Management, 29*(5), 1799-1815.

Melnychenko, O., & Savenkoa, O. (2023). *A Self-Organized Automated System to Control Unmanned Aerial Vehicles for Object Detection.* Paper presented at the The 4th International Workshop on Intelligent Information Technologies & Systems of Information Security (IntelITSIS-2023): CEUR-Workshop Proceedings.

Müller-Stewens, B., Widener, S. K., Möller, K., & Steinmann, J.-C. (2020). The role of diagnostic and interactive control uses in innovation. *Accounting, Organizations and Society, 80*, 101078. doi:https://doi.org/10.1016/j.aos.2019.101078

Nikolaou, I. E., & Tsagarakis, K. P. (2021). An introduction to circular economy and sustainability: Some existing lessons and future directions (Vol. 28, pp. 600-609): Elsevier.

Nosratabadi, S., Mosavi, A., Shamshirband, S., Zavadskas, E. K., Rakotonirainy, A., & Chau, K. W. (2019). Sustainable business models: A review. *Sustainability, 11*(6), 1663.

Nyam, T. T., Ayeleru, O. O., Ramatsa, Ishmael Matala, & Olubambi1, P. A. (2024). Management Strategies for Plastic Wastes: A Roadmap Toward Circular Economy and Environmental Sustainability *Plastic Waste Management* (pp. 31-54).

Olaizola, E., Morales-Sánchez, R., & Eguiguren Huerta, M. (2020). Biomimetic organisations: A management model that learns from nature. *Sustainability, 12*(6), 2329.

Opferkuch, K., Caeiro, S., Salomone, R., & Ramos, T. B. (2022). Circular economy disclosure in corporate sustainability reports: The case of European companies in sustainability rankings. *Sustainable Production and Consumption, 32*, 436-456. doi:https://doi.org/10.1016/j.spc.2022.05.003

Ormazabal, M., Prieto-Sandoval, V., Jaca, C., & Santos, J. (2016). An overview of the circular economy among SMEs in the Basque country: A multiple case study. *Journal of Industrial Engineering and Management (JIEM), 9*(5), 1047-1058.

Ormazabal, M., Sandoval, V. P., Leal, R. P., & Jaca, C. (2018). Circular Economy in Spanish SMEs: Challenges and Opportunities. *Journal of Cleaner Production*.

Otley, D., Broadbent, J., & Berry, A. (1995). Research in management control: an overview of its development. *British Journal of management, 6*, S31-S44.

Parida, V., Burström, T., Visnjic, I., & Wincent, J. (2019). Orchestrating industrial ecosystem in circular economy: A two-stage transformation model for large manufacturing companies. *Journal of Business Research, 101*, 715-725.

Perego, P., & Hartmann, F. (2009). Aligning performance measurement systems with strategy: The case of environmental strategy. *Abacus, 45*(4), 397-428.

Pereira, V., Nandakumar, M., Sahasranamam, S., Bamel, U., Malik, A., & Temouri, Y. (2022). An exploratory study into emerging market SMEs' involvement in the circular Economy: Evidence from India's indigenous Ayurveda industry. *Journal of Business Research, 142*, 188-199.

Persis, D. J., Venkatesh, V., Sreedharan, V. R., Shi, Y., & Sankaranarayanan, B. (2021). Modelling and analysing the impact of Circular Economy; Internet of Things and ethical business practices in the VUCA world: Evidence from the food processing industry. *Journal of Cleaner Production, 301*, 126871.

Poponi, S., Arcese, G., Ruggieri, A., & Pacchera, F. (2023). Value optimisation for the agri-food sector: A circular economy approach. *Business Strategy and the Environment, 32*(6), 2850-2867. doi:https://doi.org/10.1002/bse.3274

Prieto-Sandoval, V., Jaca, C., & Ormazabal, M. (2018). Towards a consensus on the circular economy. *Journal of cleaner production, 179*, 605-615.

Romero-Perdomo, F., Carvajalino-Umaña, J. D., López-González, M., Ardila, N., & González-Curbelo, M. Á. (2023). The private sector's role in Colombia to achieving the circular economy and the Sustainable Development Goals. *Dyna, 90*(228), 9-16.

Ruiter, H., De Feijter, F., & Wagensveld, K. (2022). Management Control and Business Model Innovation in the Context of a Circular Economy in the Dutch Construction Industry. *Sustainability, 14*(1), 366.

Ryen, E. G., Babbitt, C. W., & Kooduvalli, K. (2022). Circular Economy Research: From Theory to Practice. *Towards a Circular Economy: Transdisciplinary Approach for Business*, 25-46.

Saputra, A. I., Tambunan, S. C., & Yulianto, I. (2023). PLASTIC TAX AND CIRCULAR ECONOMY INCENTIVES TO TACKLE CLIMATE CHANGE (INDONESIAN CONTEXT). *Jurnal BPPK: Badan Pendidikan dan Pelatihan Keuangan, 16*(1), 86-98.

Seles, B. M. R. P., Mascarenhas, J., Lopes de Sousa Jabbour, A. B., & Trevisan, A. H. (2022). Smoothing the circular economy transition: The role of resources and capabilities enablers. *Business Strategy and the Environment, 31*(4), 1814-1837. doi:https://doi.org/10.1002/bse.2985

Simons, R. (1994). *Levers of control: How managers use innovative control systems to drive strategic renewal*: Harvard Business Press.

Simons, R. (1995). *Levers of control : how managers use innovative control systems to drive strategic renewal*. Boston, Mass.: Harvard Business School Press.

Simons, R. (2019). The role of management control systems in creating competitive advantage: new perspectives *Management Control Theory* (pp. 173-194): Routledge.

Sipola, J., Saunila, M., & Ukko, J. (2023). Adopting artificial intelligence in sustainable business. *Journal of Cleaner Production, 426*, 139197.

Stahel, W. (2016). Circular economy. *Nature, 531*, 435-438. doi:10.1038/531435a

Stolzenberg, R. M. (2004). Multiple regression analysis. *Handbook of data analysis*, 165-208.

Svensson, N., & Funck, E. K. (2019). Management control in circular economy. Exploring and theorizing the adaptation of management control to circular business models. *Journal of Cleaner Production, 233*, 390-398.

Ünal, E., Urbinati, A., Chiaroni, D., & Manzini, R. (2019). Value Creation in Circular Business Models: The case of a US small medium enterprise in the building sector. *Resources, Conservation and Recycling, 146*, 291-307. doi:https://doi.org/10.1016/j.resconrec.2018.12.034

urba, M. N., Sinurat, E. K. B., Djailani, A., & Farera, W. (2020). he Effect of Current Ratio, Return on Assets, Total Asset Turnover and Sales Growth on Capital Structure in Manufacturing Company. *International Journal of Social Science and Business, 4*(3), 489-500.

Urbinati, A., Chiaroni, D., & Chiesa, V. (2017). Towards a New Taxonomy of Circular Economy Business Models. *Journal of Cleaner Production, 168*, 487-498. doi:10.1016/j.jclepro.2017.09.047

Virmani, N., Saxena, P., & Raut, R. D. (2022). Examining the roadblocks of circular economy adoption in micro, small, and medium enterprises (MSME) through sustainable development goals. *Business Strategy and the Environment, 31*(7), 2908-2930. doi:https://doi.org/10.1002/bse.3054

Widener, S. (2007). An Empirical Analysis of the Levers of Control Framework. *Accounting, Organizations and Society, 32*, 757-788. doi:10.2139/ssrn.771994

Wijethilake, C., Munir, R., & Appuhami, R. (2017). Strategic responses to institutional pressures for sustainability: The role of management control systems. *Accounting, Auditing & Accountability Journal, 30*(8), 1677-1710.

Willekes, E., Wagensveld, K., & Jonker, J. (2022). *How to use management control systems to embed sustainability in the corporate culture?*

Yu, Z., Khan, S. A. R., & Umar, M. (2022). Circular economy practices and industry 4.0 technologies: A strategic move of automobile industry. *Business Strategy and the Environment, 31*(3), 796-809.

Appendix 1 – Summarized interview guide.

Section 01- Degree of adoption of CEBM

1. Briefly explain how you perceive the CEBM.
2. Does your company apply environmentally friendly purchasing criteria (ex: consideration of suppliers' compliance with environmental legislation) now? Or will your company be considering this in the future?
3. How does your company reuse, recycle or remanufacture non-biodegradable materials?
4. How does your company pay attention to reducing the consumption of raw materials, water, or energy in the design production process?
5. The findings of our survey study reflected that the 'use phase' of a CEBM (after-sales services, rental services, and maintenance services for the product) is the least practiced in manufacturing companies in Sri Lanka. Can you explain why this phrase is not frequently practiced?
6. Does your company have a process to convert non-recyclable waste materials into energy? Can you elaborate?
7. Recovering/ recollecting the products that your customers no longer use (empty containers/bottles made of glass, plastic, etc.) is one of the trends used among manufacturing organizations in the world in the process of adopting CEBM. Does your company have such a process?
8. Does your company have a process to commercialize the by-products?

Section 02- Impact of management controls on the degree of adoption of CEBM

1) Companies have rarely used this in the process of adopting CEBM. Does your company have such initiatives to make sure that your company adopts CEBM successfully?
2) Companies have rarely used this in the process of adopting CEBM. Does your company have such initiatives to make sure that your company adopts CEBM successfully?
3) Companies have rarely used this in the process of adopting CEBM. Does your company have such initiatives to make sure that your company adopts CEBM successfully?
4) In a company that successfully adopts CEBM, they frequently monitor the progress of critical performance targets, review key areas of performance, changes in critical performance variables, and deviations in previously set targets. Does your company have such initiatives to make sure that your company adopts CEBM successfully?