

## Article

# Sustainability in the Circular Economy: Insights and Dynamics of Designing Circular Business Models

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**Abstract:** The integration of sustainability in the circular economy is an emerging paradigm that can offer a long term vision to achieve environmental and social sustainability targets in line with the United Nation's Sustainable Development Goals. Developing scalable and sustainable impacts in circular economy business models (CEBMs) has many challenges. While many advanced technology manufacturing firms start as small enterprises, remarkably little is known about how material reuse firms in sociotechnical systems transition towards circular business models. Research into CEBMs integrating sustainability and environmental conservation is still in its early stages. There has been increased interest in sustainability and circular economy research, but current research is fragmented. The innovation surrounding CEBMs eludes some firms with relatively limited evidence of the transitional perspective necessary to integrate aspects of sustainability. This lack of evidence is especially applicable to the context of circular economy practices in small and medium enterprises in the United States regarding capabilities, operations obstacles, and elements of success in designing circular business models. Based on a qualitative, interview-based inductive study of a material reuse firm, our research develops a conceptual model of the critical success factors and obstacles that are part of implementing circular economy practices. Firms must first manage strategic enablers and monitor tactical enablers to achieve sustainability goals. In this study, we identify the underlying enablers of how these capabilities affect the transition to a CEBM that integrates sustainability. The framework emerging from our findings highlights the interplay of CEBM, innovation success factors, and obstacles at a micro-level. The investigation of a material reuse firm serves as the foundation for developing a framework for how managers can alter a company and revise the business model to transition towards a more innovative circular economy.

**Keywords:** circular economy; sustainability; business model; material reuse; circular economy business models; production capabilities; transition management



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## 1. Introduction

Recent sustainability advances have enabled firms to implement circular economy practices more efficiently. The circular economy (CE) removes valuable materials from waste streams by prioritizing product reuse and repair and creating restorative industrial systems [1]. According to Alhawari et al. [2], “there is increasing recognition of CE for the management of natural resources, which has resulted in a structural change in sustainability initiatives” (p. 2). Geissdoerfer et al. [3] showed many ways in which sustainability and CE are linked, from conditional to trade-offs. The growth of sustainability, environmentalism and worldwide environmental protection has influenced firms to invest in environmentally friendly activities [4]. The field of CE has rapidly grown during the last decade. It consists of reusing, reducing, and recycling material in production and consumption systems [5].

The CE can reduce the use of new materials by 32 percent within 15 years and by 53 percent by 2050, according to the World Resources Institute [6]. As a result, the CE has emerged as a realistic model for material reuse organizations, with groups such as the Ellen MacArthur Foundation and the McKinsey Global Institute seeing it as a way to divorce economic growth from the consumption of virgin resources in a changing world [7]. By implementing a CE, the U.S. business sector could generate USD 4.5 trillion in GDP growth by 2030 [8]. The CE business model involves an innovation change process. This process is significant for small enterprises, and several larger firms are taking notice, as many consider the CE revolutionary [9]. CE innovation involves updating an existing business model [10]. For a small company to succeed, it must have a well-balanced and strategically aligned portfolio of products and services that capture value while exploiting synergies and improving transition to the CE business model [11]. Although much attention has been paid to the challenges associated with implementing circular business models, no studies have focused on how the challenges differ between business models [12]. In line with this, Ref. [2] emphasized that CE has also profoundly altered the connection between economic and operational sustainability. The business model for CE and sustainability is becoming increasingly essential and garnering more attention from industry and academics [13].

The study of the CE business model concerning sustainability is still in its infancy. Likewise, the boundaries and synergies between the circular business model and sustainability are not explored [13]. Although the concept of sustainability and CE is versatile and ambiguous by nature, there is still a significant need for more specific conceptualization because of the concept's inherent ambiguity and versatility [14]. The CE business model (shortened for this study to CEBM) concept was introduced in the literature [15]. CEBM is considered an enabler of the transition from a linear, take-make-waste economy to a CE [15–17]. In addition, there is a growing demand for recycled content products [18]. This presents new challenges to management practices for small and medium enterprises to innovate and change existing business practices. Despite the growing attention that the CE concept is receiving and its implications for the industrial economic system, CE business models innovation research has been limited regarding the adoption of closed-loop production within economic systems [19]. CEBM innovation studies have investigated production planning and control, product design, and as well as on collaboration and cooperation in manufacturing-centered take-back systems [20]. According to Guldman et al. [21], “circular business model innovation in incumbent companies is the process of reconfiguring an existing linear business model to include CBM components in the form of value recreation, or the process of reconfiguring an existing circular business model to include more of, or better versions of, these CBM components” (p. 3). Ferasso et al. [16] noted that previous research on CEBM innovation exists, but more can develop conceptual frameworks. To this end, little research has focused on the challenges and processes of small-medium enterprises with CEBM innovation [11]. Therefore, it remains uncertain how CE will support economic growth while simultaneously safeguarding the environment and operational sustainability [2]. However, a growing backlash against the “win-win” narrative portrays CEs as having environmental and economic sustainability [14].

Recent interests are shifting to business model innovation for a CE and decision making, as seen in the literature review and case study work by [22]. Prior work with a single case study by [23] shows that small manufacturing firms experience more challenges when implementing CEBMs than large firms. However, the implementation of CEBM innovation in small and medium material reuse firms provides an opportunity for future research [24], calling for further examination of CEBM innovation at the firm level. A recent literature review by [25] argued for theoretical research on how contextual factors and managerial practices are linked when implementing CEBM innovation. However, we know little empirical research exists regarding how material reuse firms transform their businesses using CEBM innovation [26]. Understanding success factors and obstacles provide new opportunities for practitioners and researchers to transition conditions in small and medium enterprises. Building upon [22], we aim to explore the success factors

and obstacles that facilitate or hinder the implementation of CEBM innovation. This study examines the following primary research question: How do small-medium enterprises develop and scale a CE business model implementation at a material reuse firm level? We employ a qualitative approach while conducting semi-structured interviews with managers of a successful CE material reuse firm.

To explore these key factors and CE strategy, we interviewed all the managers at our case study firm, Construction Junction (CJ). CJ is a salvage, second hand, material reuse warehouse and retail outlet with expertise in deconstruction and recycling. This firm provides an interesting empirical context with thirty employees and eight managers because CJ has a strong social and environmental impact in Pittsburgh, Pennsylvania. This state has some of the lowest landfill costs for the disposal of building and office waste at the state level in the United States (U.S.). Our research represents a timely attempt to consider the micro context of a successful SME in the U.S. when many manufacturing SMEs are trying to develop businesses as part of an emerging CE. This business was founded in 1999 by the Pennsylvania Resource Council as a non-profit for surplus building materials, collection, and selling of these materials. CJ is a leading CE material reuse firm that helps deconstruct building sites and supplies recycled building materials, appliances, and hard and soft goods, such as doors, windows, wood flooring, art/craft, batteries, even bikes, and consumer electronics.

The size of material reuse efforts differs by region; it is far smaller in the US than in Europe, which is lower yet than in Japan, partly due to the complicated nature of the European market system [23]. Nevertheless, the federal and state governments of the US are encouraging various measures and regulations to help the remanufacturing business [23]. This study provides an interesting empirical context due to CJ's strong social and environmental impact and its position as a pioneer of CEBM innovation in Pittsburgh, Pennsylvania. This state-level context is important as the cost to dump building waste in a landfill (i.e., USD 23 per ton tipping fee) is among the lowest in the country. This cost-competitive environment makes the development and growth of a CE business difficult as it competes with low-cost disposal baked into traditional linear take-make-waste economies. In addition, Pittsburgh is an excellent geographical setting for this case study for several reasons. To start, CJ is in Pittsburgh, a city within 500 miles of half the population of the U.S., experiencing a rapid increase in green business initiatives, high-performance buildings, and new business opportunities.

The investigation of what occurred in our study serves as the foundation for developing a framework of how managers altered the company and revised the business model to transition towards CEBM innovation. The findings of this study have several theoretical and managerial applications. First, using a qualitative methodology while applying the transition management theory, this study uses this theoretical basis to understand what new course of actions accelerates the possibilities for the renewal of the existing capacity to innovate the CE business model in sustainability. Second, our results reveal that governance and resource management is needed to ensure sustainable technological and infrastructure operations. This study offers a conceptual framework to investigate critical obstacles and key enablers' impact on an organization's readiness towards transformation to CEBM to achieve sustainability objectives. The framework can help anticipate possible transitions and guide management towards more desired CE business model initiatives.

Next, as CEBMs sustain and bolster innovation, several things are becoming more apparent regarding where material reuse firms should focus their attention. These include pricing strategy, convenience store design, breadth of services, handling, storing, and disposal of materials. Finally, this study shows that material reuse firms' readiness for CEBM transformation requires different production and operational capabilities. The most important are building material design and management strategies. The benchmark services of the product use cycle, resource management capabilities, and market management communication may positively affect the CEBM innovation transition. To help build theory within a small and medium enterprises transitional context, CEBM innovation scholars

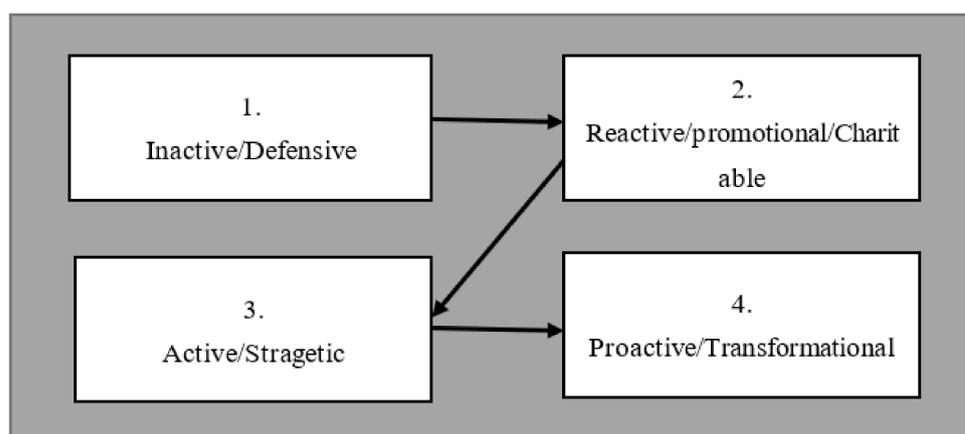
can learn from the capabilities, overcoming obstacles, and insights from the framework developed in this study. This insight can help explain and predict enterprise behavior in the future.

In the following sections, we present a literature review regarding CEBM innovation, the CE, and success factors. We subsequently provide evidence from the literature regarding the background and growing importance of CEBM innovation. Next, we present a conceptual framework of the CEBM innovation, our field study methodology, and findings. The final section provides conclusions from the study, managerial implications, and suggestions for future CE research.

## 2. Literature Review

### 2.1. The Relationship between Circular Economy and Sustainability

The CE literature also addresses the economic and environmental aspects [14]. Sustainable development objectives (SDGs) such as SDG 12 (sustainable production and consumption patterns) are expected to benefit from the transition to a more circular economy [27]. Several authors have emphasized the necessity of including sustainability in CE business models [2]. However, a circular economy necessitates a thorough understanding of the infrastructure that supports recycling and remanufacturing [27]. Geissdoerfer et al. [3] showed many ways in which sustainability and CE are linked, from conditional to trade-offs. vanTilburg [28] suggest a simple typology of sustainable business depicted in Figure 1. The authors denote the following designations of a firms' motivation for sustainability: inactive when sustainability is a burden for the institution; reactive, often a social response focused on reputation; active, utilizing sustainability as a marketing opportunity, or proactive with prioritization of product improvements. Business model innovation is concerned with increasing positive benefits, harnessing opportunities, reducing negative impacts on society and the environment while fostering growth. Thus, innovation fosters external collaboration and changes in the way organizations interact with their networks [29]. Although CE is commonly used to achieve sustainability, the focus is more on the economic and environmental aspects of the equation. Firms must modify how they generate value, comprehend, and conduct business to achieve more sustainability and circularity [3].



**Figure 1.** Key components of sustainable entrepreneurship. Adopted from [28].

Sustainability issues are becoming more important to both policymakers and businesses [3]. The Brundtland Commission has the most commonly used definition of sustainability: “development that fulfills the present needs without putting future generations at risk of not being able to meet their own needs [30]. The BMI sub-stream devoted to sustainability has evolved dramatically over the last decade [13]. The authors of Short et al. [31] provide tools for transforming business model archetypes' value proposition to help describe sustainability innovations. Additionally, Schulgrate highlights the process as involving different stages of innovation and emergent changes. The above archetypes and

components of sustainable entrepreneurship provide a foundation for “how” and “why” CEBMs can capture value in new ways. It also helps validate why it is important to include a material reuse firm’s transformation within our research objectives. A researchers’ ability to get inside organizations to investigate how and why transformations occur can provide new insight and contributions to the field not available through secondary data sources and a lack of direct observation. The CE offers new management research opportunities as enterprises create value with circular resources [32]. According to the literature, the CE encompasses concerns ranging from restorative waste management that permits the development of business models and the efficient approach to consumption and production [7]. These dynamic factors indicate that CE practices are economically viable and part of a newly redesigned business model [33].

In recent years, management scholars have become increasingly interested in the impact of CE practices on business models (BM), driving the transition towards sustainable development [34]. Since the mid-1990s, two viewpoints on strategic management have arisen: The dynamic capabilities (DC) paradigm as a way of understanding how things work [35] and the business model [36]. A higher-order capacity enables a company to integrate, grow, and reconfigure internal and external resources to respond to quickly shifting business situations [35]. Teece [37] was among the first to suggest the theoretical perspective of DC on BM design. Creating a new, adaptive business model has long been regarded as a micro-foundation of dynamic capabilities [11].

Teece [37] disaggregates DC into the capacity (1) “to sense and shape opportunities and threats,” (2) “to seize opportunities,” and (3) “to maintain competitiveness through enhancing, combining, protecting, and, when necessary, reconfiguring the business enterprise’s intangible and tangible assets” (p. 1319). Khan et al. [38] noted that DCs increase the implementation of CE practices. Further, Alhawari et al. [2] describe CE “as the set of organizational planning processes for creating, delivering products, components, and materials at their highest utility for customers and society through effective and efficient utilization of ecosystem, economic, and product cycles by closing loops for all the related resource flows” (p. 22). In the natural environment, industrial ecology is a subdiscipline that tries to reconstruct the industrial ecosystem by controlling and creating linear to closed-loop industrial production and consumption systems. Industrial ecology aspires to establish harmonious relationships between natural and human systems to deliver long-term advantages in all elements of sustainability, including social, environmental, and economic well-being and prosperity [27]. A powerful attribute that the CE provides to businesses is a system for developing symbiotic consumption and production models to improve the business’s sustainability [39]. In line with this, knowledge-sharing policies are a critical factor in ensuring the long-term viability of an organization [40]. Recent scientific studies drawing on the CE literature have addressed the development and implementation of business models [20,26]. This business model design aims to improve product transformation, encompasses choices in organizational structure, and can be put together with a circular design and material reuse capabilities to create new value [36,41]. According to Osterwalder et al. [42], “a business model describes the rationale of how an organization creates, delivers, and captures economic, social, and other forms of value.” Business models have three main elements (1) value proposition; (2) value creation and delivery; and (3) value capture [41].

A business model describes the architecture of how a firm creates and delivers value to customers and the mechanisms employed to capture a share of that value [43]. According to [44], CEBMs aims to “create, deliver, and capture value while implementing circular strategies that can prolong the useful life of products and parts (e.g., repair and remanufacturing) and close material loops (e.g., recycling)” (p. 187). Similarly, business model innovation according to Schaltegger et al. [45] is a means of “increasing the effectiveness of business strategies” (p. 109). Among scholars, the CE is gaining more attention. This is because of its opportunity to be a revolutionary, innovative model to design products for continuous reuse and preservation. It entails emphasizing redesigning and rethinking numerous facets of the production and consumption chain through ongoing and collab-

orative learning with stakeholders' actions with minimum risks and resources [46]. As a vehicle for transforming organizational processes, CEBMs concentrate on closed-loop manufacturing, material reuse, extending product life, and developing new recycling methods for extracting a material's embedded value [32]. For this study, a CEBM is: "a business model in which the conceptual logic for value creation is based on utilizing the economic value retained in products after their initial use and reuse offerings" Linder and Williander [47]. According to [13], CEBM innovation incorporates principles or practices from CE as guidelines for business model design. Scholars highlight the need to analyze existing business models and firm-level factors to improve our nascent understanding of implementing a CEBM innovation [48,49].

CEBM benefits are still emerging as we have a greater awareness that the traditional linear economy (i.e., "take-make-waste") is unsustainable as it is focused on exploiting resources and consumption [33]. CEBM innovation represents a critically important business strategy for slowing down material loops [50] and implementing procedures for individual design choices [51]. However, significant research is still required to gain deeper insights into the importance of CEBM with case studies across industries [21]. For example, in the case of Ricoh UK and Europe, the company's long-standing dedication to using remanufactured and recycled material has resulted in the development of internal collaboration and cooperation, cutting resource consumption by 25% from fiscal 2007 levels by 2020 and 87.5 percent by 2050 [52]. At the same time, CEBMs pose a contemporary challenge for academic scholars to understand their innovation, enabling practitioners in their efforts to reduce, reuse and recycle material to transition to a more sustainable future [25]. There is also growing skepticism about the purpose they serve and the management mechanisms, processes, and capabilities firms need to transform to a CEBM innovation [9,53].

CEBMs can be regarded as a part of a more extensive collection of sustainable business models and practices [29]. Ghisellini et al. [19] discuss the origin of CEBM and distinguish both micro and macro levels. Lewandowski [54] highlights the potential for CEBMs to focus on resource conservation and slowing resource loops while developing new forms of value creation. Their findings indicate that a CEBM capitalizes on new revenue streams by focusing on recycling and reusing material, thereby minimizing the cost of purchasing virgin materials. There are two approaches typically involved in closing and slowing resource loops: circular services and product design [55]. CEs include maintenance, material reuse, repair, reuse, redistribution, refurbishment, remanufacturing, upgrading, recycling, and energy recovery [3].

There are also two types of closed-loop cycles: up-cycling, when the end-of-life material is reused as input for producing a higher value product than the original; and down-cycling, when the end-of-life material is reused as input for producing a product of lower value [56]. Recycling models build on closed-loop cycles [57]. It provides opportunities to utilize inputs, enable elements of success, and realize the dynamic impacts of emerging CEBMs [58]. Remanufacturing and refurbishment allow firms to offer new or even greener products [57]. Remanufacturing is more extensive than refurbishment and results in items as good as, if not better than, those produced when new [59].

Utilizing various resource recovery strategies, in which end-of-life products are transformed into materials available for manufacturing through recycling and upcycling services, requires the development of different reverse cycles [58]. Reverse cycle is defined as "reverse cycles can be translated into viable business" (i.e., value creation for the company and its customers) [58]. According to the producers, employing recycled materials will substitute virgin materials, lower production costs, and allow for more significant product differentiation [58]. CEBMs are a critical element necessary for the development of a CE. However, little is known about how small and medium enterprises develop and deliver sustainable innovation within the context of new CEBMs [22].

## 2.2. A Transition Theory Framework

Some scholars have discussed the need for a linear to CE business transition [54]. This transition management (TM) is a relatively young interdisciplinary research field rooted in system thinking [60]. Within this context, a transition is defined as a gradual and continuous change to a new dynamic equilibrium from an initial dynamic equilibrium (stable system) [61]. Brugge and Raak [62] go further, saying TM “is concerned with the dynamics of structural change in societies, and when and how transformations can be initiated, facilitated, and influenced” (p. 32). TM also has roots in adaptive system theory and [63], which is concerned with the possibilities for recombination, renewal, and the introduction of new actions generated by disruption [62]. Moreover, transitions seem inevitable from the perspective of limited resources and ecological thresholds that arise from the coevolution of society, economy, and ecology [64]. As a result, TM enables firms to adapt to situational demands, resulting in learning-oriented management strategies [62].

In the TM literature, there are mainly four types of transition phases (1) “pre-development,” (2) “take-off,” (3) “acceleration,” and (4) “stabilization” phase [62]. The take-off phase can be defined as a transition from preparatory to outline what must-do for the initiating change and stimulating transition processes [62]. These phases partially align with [62], distinguishing between strategic, tactical, and operational level transition management. They differentiate between strategic and tactical level transition management, with the strategic level allowing for long-term goal formulation and the tactical level enabling agenda building and networking [61]. As the strategic level deals with what to do and how to do it, following [62], we propose that the take-off phase of TM conceptually constitutes a phase change from preparatory to transitional.

A transition is further described as a management approach for changing the traditional business model’s conditions into another system under different requirements. Transitions are thus operationalized as multi-level processes [65]. TM emerged as a core transition mechanism explaining transition scenarios, arenas, and monitoring [62]. The CE concept is gaining attention as it can be a critical element for a permanently regenerative economy, reducing negative environmental impacts and stimulating new business opportunities [66]. The transition from unsustainable consumption to increased resource efficiency and waste reduction is growing [67]. We would predict that the importance of this transition will only grow in the future. CE is a dual-loop regenerative system that simultaneously focuses on the effective and efficient use of resources in the ecosystem to boost resource eco-efficiency and resource effectiveness [2]. The transition from traditional business models to CEBM requires companies to enact formal performance improvement systems [68]. The cornerstone of organizational transition is to invest ample resources into the new business while identifying new roles, exploring new skills, and shifting organizational design to manage itself without further support [69]. In the absence of understanding TM, there is a risk that the firms fail to recognize the multitude of opportunities and challenges that give rise to transition [70]. Building on TM theory, we posit that transition pathways are simultaneously confronted with the mobilization of actors and knowledge development. This will result in an in-depth evaluation and analysis of their activities and the relationships within organizational structures. Therefore, it is necessary to take a TM theory perspective into account, emphasizing the need for structural change to explain alternative success factors and obstacles at the micro-level for CEBMs.

As a result of this need to recognize opportunities and challenges, scholars and practitioners have emphasized the critical role of business models in effecting systemic change [22]. There is a dearth of understanding of their precise function in transitions and the methods through which they influence transition dynamics [71]. Business model research can benefit significantly from the insights gained from studying a transition perspective [71]. There has been little reflection on accelerating the CE transition in creating and delivering value to individual material reuse firms [72]. In this context, we mainly focus on investigating transition routes (scenarios) through experiments and collaborative efforts, development, and deployment of adequate tools [73]. In Zolfagharian et al. [70], the

authors acknowledge that previous extant research studies have adopted various quantitative techniques and single case and comparative case studies. Here we see TM as providing interplay between existing ecosystem functioning and renewal, suggesting which organizational capabilities and external factors enable the transition towards implementation of CEBM [54]. To this end, Bocken et al. [29] have proposed a categorization of sustainable business archetypes to assist firms aiming to expand their BM transition scope (see Figure 2). The salience and importance of TM indicate that it enables organizations to understand when and how to initiate change to achieve set goals. With little known about the mechanisms underlying a successful transition towards CEBM innovation, we have positioned this study to fill this gap in the literature.



**Figure 2.** Categorization of sustainable business archetypes. Adopted from [39].

### 2.3. Insights on Production Capabilities, Operations Obstacles, and Elements of Success

Engaging in the CE can create economic growth opportunities and catalyze necessary changes for a well-balanced economic and environmental system [19]. The transition from a traditional linear business model to a CEBM innovation is central to implementing more sustainable business practices across the system. While CEBM innovation is an emerging field related to sustainability, it has contributed to integrating the traditional management field with new sustainable business model innovation [22]. There are calls for more research on the development and change management of CEBM innovation [22]. Researchers in this evolving field of a business model process [74] and implementation of BM innovation [19] have reached some consensus regarding the importance of looking at the organizational change process. Geissdoerfer et al. [75] provide potential benefits, and challenges organizations face when creating and developing business models. Our aim in this study is to add to this growing field of research.

The literature conceptualizes the BM as a process and outcome with organization performance implications. Among these studies, e.g., [76] divided the BM process into three streams, antecedents, process, and effect. We argue that the change process in firms is associated with identifying antecedents and strategies for implementing CEBM. Further, Santa-Maria et al. [22] developed a framework and classified CEBM innovation as an organizational change process. This literature brings attention to the conceptual development of CEBMs and should be considered in future studies, as it provides a foundation for understanding CEBM transition management [77]. For example, Lüdeke-Freund and Dembek [78] discussed the state of sustainable business models. Tura et al. [79] identified the internal and external barriers and drivers in various areas of an organization, such as technological and informational, organizational level, social, and environmental. Strong DCs necessitate good business model design [43]. Key strategies, resources, and capabilities for implementing circular economy in industrial small and medium enterprises and [11]

identified DCs, as an antecedent of CEBM implementations. Foss and Saeb [80] caution that implementing BM in an organization requires a change process in its existing practices.

Dynamic skills are multifaceted, and organizations will not always excel at all of them. However, the strength of a company's DCs contributes to its ability to build business models effectively [43]. DC research involving the CE by [11] provides a starting point for examining benefits. The literature on firms' DCs and CE practices has emphasized the importance of reconfiguring strategies to attain CE objectives [38]. The authors of [81], on the other hand, observed that this theory needs further investigation in the context of environmental management studies. Ref. [82] Looking at DCs for eco-efficient operations depends on integrating and coordinating talent, innovation, and new routines throughout various firm functions. The framework of the DCs model reflects interdependence and guides organizational transformation [43]. Further, Ref. [38] argues that such DCs are likely to amplify perspective in creating and reconfiguring resources for CEs in this dynamic business environment. In the process of translating business model changes into organizational transformation, the strength of a firms' skills can be called into question [43].

Organization change management ensures that planned changes are implemented effectively [22]. Rizos et al. [83] tried to understand barriers and enablers for SMEs in implementing CEBMs. Moreover, we know that the implementation of CEBMs requires collaboration through the value chain [84,85]. Some studies caution that organizational upheaval may cause a lack of coordination and may lead to the loss of the organization's shared values and beliefs [80]. Pieroni et al. [86] emphasized that firms need to carefully design CEBM innovation while considering inputs from qualitative research studies. Others describe the importance of process development for CEBM design often entails uncertainties and complexities [21,47]. For example, Ref. [46] suggests that firms successfully implement innovation in CEBM when they are inclined towards experimentation and organizational learning. Refs. [83,87] presented their findings. They mapped the benefits of CEBM innovation by suggesting that top management is a crucial enabler in the redesign process. Ref. [25] argued that top management could realign resources to achieve the set goals with the firm's objective. Bocken et al. [10] explored uncertainties such as customer perception of used products, safety, and risk in a transition towards CE.

The introduction of remanufacturing into the industry, which Xerox and Fujitsu dominated, resulted in a convergence of capabilities and incentives that encouraged the existing business to embrace remanufacturing and assert reuse as a natural extension of core CEBMs [23]. Birkinshaw and Ansari [88] recommend that structuring a firms' internal management is vital for implementing a successful CEBM. According to [89], prioritizing actions and capabilities can play an essential role in transforming a successful and strategic business model. Capabilities refer to deploying resources and accomplishing a target via organizational processes [9]. The term "competence" is the degree of skill in the task's performance [90]. These new capacities evolve throughout time due to path-dependent learning processes [9].

Previous research demonstrates that reorganization and technical advancement are critical DCs for CE implementation [11]. Successful leadership depends on managing complex business models and managers who can make decisions, facilitate work environments that encourage employee commitment, and implement practices that lead to the overall achievement of specific goals [69]. Prior case-based research has found that leadership commitment towards "capacity-building and information management for CE" is essential. So are appropriate reuse and waste recycling facilities to help material reuse firms transition to a CE [91]. Applying the business model design process in CEBMs can trigger a transformation of the firms' structure, focusing on rethinking business models [67]. CEBM has been looked at as how business processes capture value by repairing and reselling products or reusing and upcycling these materials [32]. Reuse and remanufacturing of products can drive and facilitate extending the life cycle of a product [92], decreasing the amount of waste sent to landfills. As [93] points out, innovative business models such as CEBMs help bring products to market with incremental and novel changes. The CEBM

positively impacts the environment and society by creating and delivering new products and services to customers, helping to trigger new revenue streams from resource-efficient and circular resource flows. These models provide an opportunity to reimagine capitalism (Henderson, 2020). From an institutional perspective, governments help firms develop the capability to implement CE practices [94]. Leadership in the public sector also calls for business leaders to put their faith in direct government intervention that could enable companies engaged in product life extension to scale up their operations and pave the way for a transition to continuous extension [95]. Following this logic, we review the literature on how to transition a business to understand the necessary conditions for a successful transition in a CEBM. We try to understand the integration of sustainability into business models and practices [94].

As [96] reported, internal and external forces enacted by individual firms and governments alike strongly influence CE practices in the value chain. Stakeholder collaboration is essential for value creation. [67] indicate that the transition to a functioning CE requires multi-level change into the new business model. This carry-over includes stakeholder collaboration and technological innovation with opportunities for field studies providing new insight. Figure 3 illustrates the elements of success, inputs to the CE, and pathways to CEBM innovation. Further, green technologies are critical in creating and developing long-term sustainable and environmentally friendly initiatives [97]. A firms’ ability to successfully transition to a CEBM innovation depends on many factors, including knowledge and skill (capacity building), organizational innovation (integrating solutions and logistic models), social innovation (new production and consumption models), technological innovation (design of materials and process), and multi-stakeholder involvement [98].

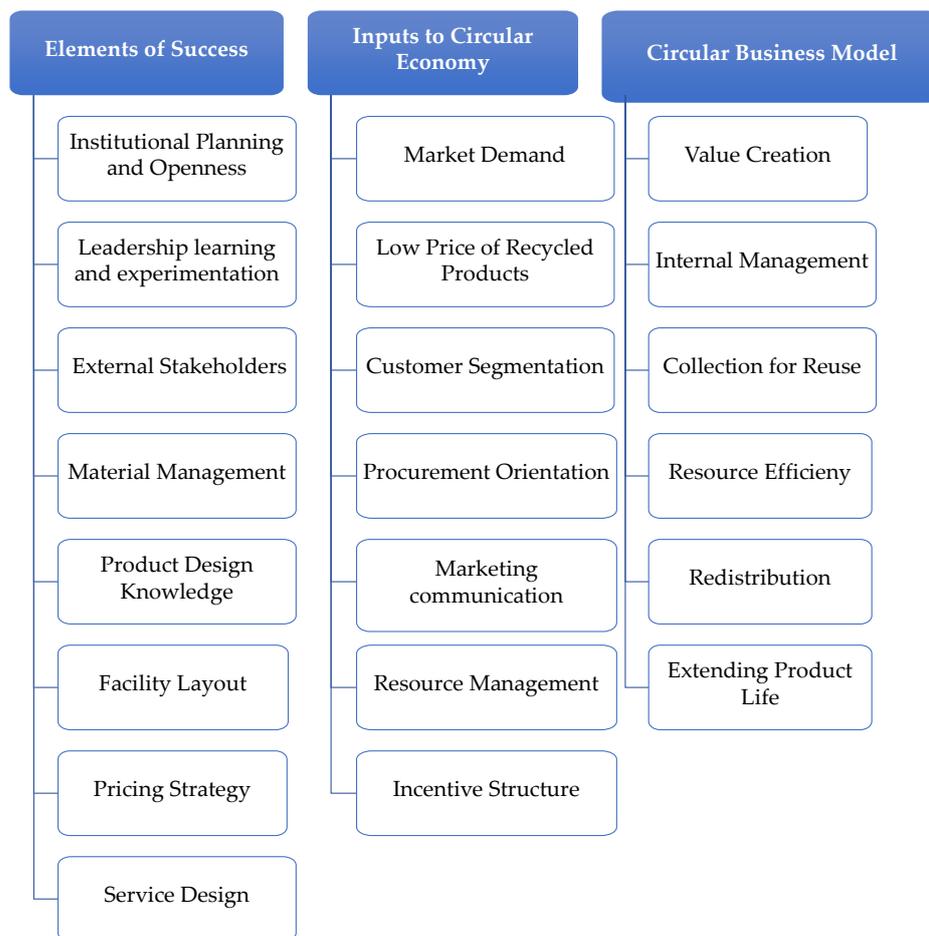


Figure 3. Business model success, inputs, and design elements within system boundaries.

Sustainable innovation can significantly contribute to the achievement of other UN SDGs that are inextricably linked [99]. Helfat and Martin [100] found that managerial capabilities modify how a firm helps to enable strategic change and organizational performance. Such management competencies are essential in designing and implementing new business models [43]. Further, Ref. [101] has highlighted the need to explore the vital organizational capabilities for CE development and implementation. We see internal organizational alignment, capacity building for material reuse, and recycling as important elements of the literature. These elements can provide firms with an opportunity to transition from traditional linear models to CEBM innovation.

### 3. Methodology

#### 3.1. Case Study

We employed a case study research methodology to examine the organizational transition process to a CEBM innovation. The Construction Junctions company (CJ) was founded in 1999 by the Pennsylvania Resource Council, a non-profit start-up and surplus building materials, selling, and collection. It has grown significantly and has diversified business operations. CJ is a leading CE material reuse firm that supplies reused and recycled building materials, appliances, and hard and soft goods, such as doors, windows, wood flooring, art/craft, batteries, bikes, and consumer electronics. We identified CJ as a purposeful case study due to the innovative nature and trajectory of success over time. This study provides an interesting empirical context due to CJ's strong social impact and its position as the pioneer of the CEBM in Pittsburgh, Pennsylvania, a state with some of the lowest landfill costs at the state level in the entire country (i.e., USD 23 per ton tipping fees). Despite the low competing costs of waste disposal in the region, CJ is a pioneer in reuse and successful CEBM development.

They collected and sold end-of-life and surplus material from customers through community development programs aimed at different events. For example, they opened a center for creative reuse for the regional community (Pittsburgh region) and offered other free-of-cost events and services to the people of Pittsburgh. The case firm has provided a platform to the community to come and make creative use of materials. People could donate used and surplus products in these events and develop new products by reusing the materials and finished goods. Pittsburgh is an attractive geographical setting for this case study for several reasons. To start, CJ was created within a city that is within 500 miles of half the population of the U.S., is experiencing a rapid increase in green business initiatives high-performance buildings, has an aging building infrastructure, and new business opportunities. CJ offers to repair and reuse end-of-life products from deconstruction projects and offers refurbished products by adding new features and using materials and parts extracted from recycled products with over a million dollars in annual sales. We focus on sustainable entrepreneurship as CJ has already implemented circular practices leading to reconfiguring business opportunities. These CE practices provide lower prices for consumers and efficiently use resources that otherwise would have been sent to landfills. CJ is a business developed and advanced by the environmental community in Pittsburgh with three primary catalysts: Conservation Consultant Inc. (CCI), Pennsylvania Resources Council (PRC), and the Green Building Alliance (GBA). These organizations initially looked at this as a development opportunity that addressed the city's need to have an organization that was diverting used building materials from landfills and making these materials available to the public. This organization started in the mid-90s when only a few organizations did this nationally. The research and benchmarking helped management understand this emerging business model. This research included touring The Loading Dock, an NGO in Baltimore, and the first large-scale, for-profit organization called Urban Or launched in the 1970s.

There were a few more organizations benchmarked through phone calls and networking. When the Executive Director started working on this project, he went to a reuse and recycling organization such as CJ in Minneapolis, Minnesota. The Executive Director and

others trying to develop this business was not sure many CJ-like organizations were out there at that time. The three catalyst organizations did fundraise with CCI funding the initial business planning and feasibility assessment with local contractors. These catalyst organizations formed an advisory committee of contractors interested in the CE. They found others supporting this type of business model development. PRC became more involved when it came time to write the business plan and launch the operation. At about this same time in the organization's development, they received phone calls about how to dispose of building materials. This combined business plan development and community calls were a one-two-punch leading to the PRC agreeing to be the fiscal sponsor while CJ started. The key capabilities and resources for building this business varied at different stages of development. The key to success, in the beginning, was the initial grant funding. They started by developing a business plan and finding out if there were sources of materials for a new material reuse business. They then started taking the business plan to foundations in the region (i.e., Pittsburgh) and finding ways to fund it. In doing this, CJ received USD 200 K to launch the business. That was necessary because CJ did not have any contractors with materials lined up to kick this off. CJ started under the PRC's 501C3 status and is now its nonprofit organization.

This enterprise started by collecting end-of-life products and making available the same product or upcycling products to customers. The Pennsylvania Resource Council founded CJ in 1999 as a nonprofit, collecting surplus building materials and then selling and redistributing these products. They collect and sell end-of-life and surplus material from customers through community development programs with on-site collection events and drop-off options. CJ has developed its business model over several years. More recently, they have opened a center for creative reuse for the regional community (Pittsburgh) and offered different events, free of cost, to this city's people. CJ has provided a platform for the community to come in and co-create new products from refurbished materials. People can donate used and surplus products to these events and develop new products by reusing the materials and parts.

Case studies in specific contexts can be an effective way to gain new insights since they provide boundaries, enabling researchers to understand the subject matter under investigation. In CEBM innovation, there has been a long-running debate about the merits and usefulness of single case studies in current research. Scientists frequently take one of two positions: the first favoring single cases, with the second favoring multi-case studies of firms with similar conditions. The single case study approach is beneficial in exploring in-depth phenomena on the micro-level. Many previous studies have used this data collection process to study the change in organizations. For example, [102]. Single case studies remain an essential part of today's scientific investigations. Gerring [103] brings up external validity, saying that "to be a case of something broader than itself, the chosen case must be similar (in some respects) to a larger population" (p. 248). Indeed, single case-based research shows the inner circles' role (maintenance, repair, and reuse) in successfully transitioning to a CE from a linear economy. The case study approach applied to organizational change is particularly appealing in capturing the complexity and richness within an organization.

In contrast, using a survey design methodology may be seen as a means by which a bias occurs towards the organizational members, underscoring the significance of the organizational reality [104]. In the context of our study, following [105], intrinsic case studies may be particularly applicable to program evaluations. The case study approach to organizational change is particularly appealing in capturing the complexity and richness of the organizational life while avoiding the bias of survey design [104]. Following [105], intrinsic case studies may be particularly applicable to program evaluations within this study's context. A single case approach is relevant to our study context as we are interested in exploring the critical success factors for the CEBM innovation. Our unit of analysis is "embedded" because data comes from multiple levels within one case [106]. This unit of analysis informs a detailed understanding of the natural and complex phenomenon under study. The unit of analysis in a case study allows us to look at a single organization [107].

A single case and embedded unit of analysis study approach are beneficial in exploring in-depth phenomena on the micro-level, as many previous studies have successfully used this data collection process to study organizational change [102]. An embedded unit of analysis involves different organization members at the level of analysis for the organization.

### 3.2. Data Collection and Analysis

The data collection process started with a purposive sampling technique designed to find sources of information that may be used to address the research question [108]. We collected semi-structured interview data from the organization's top managers about implementing CE practices about the application in reuse, remanufacturing, and recycling. The study used a cross-case explanation and pattern matching approach to ensure internal validity, which is particularly well suited to semi-exploratory research [109]. The individual interviews were conducted at the CJ office and business site in August through September of 2019, with follow-up emails and phone calls for clarification as needed. Semi-structured interview techniques probed informants regarding success factors, necessary capabilities and resources, obstacles, partnerships, suppliers, and customers that help transform the business concept into reality. Each semi-structured interview lasted an average of two hours with each respondent to elicit the necessary information. All accessible secondary data were gathered and triangulated with data from direct interviews to increase the research's reliability.

The interviewees were informed of the field study and approval from the university to conduct the research. All data would be kept behind a firewall, and names would not be used in any published materials. The interviews lasted for up to one hour and included tours of the facility and areas of responsibility for respondents. Researchers transcribed and verified the discussions to increase validity [106]. Data from one respondent was collected and analyzed before interviewing the next respondent. Important issues in early interviews can be included in the evolution of a protocol for subsequent interviews. Improving and refining a protocol between interviews is a significant advantage of this type of research.

Two main aspects of analysis include within and cross-case assessment. The within-case analysis focused on the elements of CMB development in a single respondent context. The cross-case analysis utilizes replication where one respondent's constructs of interest are tested with other respondents [109]. We attempted to control for the effects of the researcher's a priori belief regarding why CEBM transformation was taking place. The primary researcher accomplished this by writing up the field notes before further conceptual analysis or coding. The secondary researcher at the interviews reviewed these notes. We also included one or more persons not involved in the data collection to review the field notes. Discrepancies between researchers were clarified through follow-up phone calls with the respondents.

We conducted individual semi-structured interviews with eight managers and informal discussions with some employees. The information collected during the face-to-face and follow-up telephone interviews consisted primarily of keywords. Individual interviews were crucial in elucidating how material reuse firms design different practices and drive a transition to CEBM innovation. Since interviewees provided the majority of the qualitative research data, the approach for selecting respondents was focused primarily at the management level. They were required to have a working knowledge of CE and its history. We interviewed all eight of CJ's managers. Of these, half were newer to the organization, leading the researchers to focus more on managers with a long history within the enterprise. We also interviewed two board of directors and the president of the Board of Directors for the NGO that helped get CJ started as a business.

We used inductive data analysis methods. It produces ideas based on data collected inductive qualitative analysis consisting of two thematic content analysis and narrative analysis [110]. Thematic content analysis is used in business and management research [111]. We adopted thematic content analysis because of its advantages for studying complex configurations, where various causal factors combine to produce outcomes [110]. Although

it applies to various qualitative research methodologies, this method of data analysis is especially advantageous for some approaches, such as phenomenology. A thematic analysis attempts to find patterns of concepts in interview data. First, thematic analysis is suited to explore interview data and better understand the manager's everyday work routines and how they use different sources to handle the operations. Second, it can identify multiple themes that emerge from data and help to evaluate a different set of theoretical relationships. We began by examining each interview transcript using an "open coding" technique similar to that adopted by [112]. Our study involves the Director of the organization; The President of the Board of Directors of the Pennsylvania Resources Council, the NGO helping to create CJ; informal interviews with two other board members; along with the General Manager; and the Donations and Logistics Managers of CJ. We support the interviews with a review of publicly available information from the case firms' website, annual reporting, and websites of other organizations involved with the formation of CJ. The respondent we selected were coded as respondent1, 2, 3, 4, and 5. The development of an interview protocol (see Appendix A) is based on the essential attributes of CEBM innovation, the CE, and elements of success from our literature review.

#### 4. Result and Insights

The interview transcripts were analyzed using a qualitative analysis approach based on the paradigm by [113]. This approach is iterative and contemporaneous, consisting of four stages: comprehending, synthesizing, theorizing, and recontextualizing. The researchers transcribed the interviews. To help ensure accuracy, transcripts were cross-checked with field notes to ensure the coded themes' consistency. At the comprehension stage, the authors were able to gain a general grasp of the interviews by line-by-line examination of the transcripts. Once the authors became familiar with the data, they began to extract the meaningful units from the narratives that they had previously collected. After that, it was time to synthesize the information and look for patterns and correlations among the significant pieces. We accomplished this by comparing the emergent meanings in the coded dataset. Themes were developed during the theorizing stage of the research. Themes helped to determine associations among topics that demonstrated connections among themes. Major concepts were then developed at the final stage. Important and relevant insights were deduced from the themes.

These insights include knowledge of the marketplace, benchmarking, various materials, communication, marketing efforts, and building up the appropriate staff with representative insights from interviewees. There was a more apparent expectation that understanding the materials marketplace would be critical to success. The two components of this business model we needed to think about were the capabilities of the supply chain and the demand for materials. The supply side is challenging as CJ needed to understand who has the material, obtain it, and get someone to donate it and not sell it to CJ. The findings highlight that characteristics of the products, such as refurbished or remanufactured, biodegradable or produced with reused water and energy, and repurposed or based on recycled materials, directly impact the decision to use it. Indeed, the degree of awareness of the characteristics of the products was important to the successful reuse of the product materials.

Knowledge of the marketplace:

*"We needed to find people who have stuff they want to get rid of. Construction, retailers, wholesalers . . . a location with loading docks, centrally located, where people could easily drop stuff off. We get people motivated to keep materials out of landfills, this has some bearing on the decision to reuse it, and those same people are part of the market also looking for used and reused materials at a later time. If you are a homeowner, you might think, 'I cannot throw this away.' If you are a business, you don't want to pay to throw it away, but what people are really looking for is for someone like CJ to take this stuff away for free or for a tax donation."*

(Executive Director, Respondent ID#1)

Business support services, such as planning and development, are required in order to achieve the necessary improvements and results. The more a firm focuses on business support services, the higher the expectation it will achieve its desired goals.

The Breadth of Services:

*“What we found from talking with other reuse businesses is that it is essential to pick things up. Get a truck and collect material. The same goes for drop-off for people, and this also has to be convenient.”*

(Manager, Respondent ID#5)

Another factor predicting the expected degree of implementation of CE practices to redesign the existing business model at the transition stage concerns the capabilities for extending the product use cycle (i.e., product life cycle). Thus, a material reuse firm needs to focus on ongoing repair, delivery for various materials, and continuous monitoring and optimization of spaces for more materials.

Variety of materials:

*“Once we got to the point where we amassed enough material, variety and (the most important thing is the variety of material we have).”*

(General Manager, Respondent ID#2)

The respondents acutely felt the importance of communication and marketing while building brand reputation. While focused on developing relationships, internal organizational policies support communication strategies while boosting resource efficiency and effectiveness.

Communication and marketing:

*“This contributes to the overall product mix customers find when they come to CJ looking for items. Developing a relationship to let people know about the services we offer is critical.” “The next part of the transitional process is letting people know we are here and they can shop for used building materials . . . so we pushed messaging out into media, tv, radio, free stories in newspapers.”*

(General Manager, Respondent ID#2)

The general manager told us a success story involving resources being the “growth of CJ since having a couple of people to start, outgrowing the original space, how having an entire building for job training, a job institute, collaboration with Goodwill, and project RE (introduces new constituents to the reuse movement). The Urban Design Center, trade institute of the city, and other partners are coming to the site to be part of CJ university, where anyone can conduct courses, hold classes, and do training of all kinds. Beyond the collaborative activities that help reconfigure an existing linear BM, we found that management needs to build employee skills. There is a need for skills along with staff enabling renovation with the end of use products. These skills come through on-the-job training, partnering with public and private institutions on inventory storage, take back, and logistic handling.

Staffing:

*“We needed to find staff. Then you need the infrastructure for the retail material. Almost from the beginning of CJ, we have had to have someone whose sole responsibility is to the source material and the resources to collect the material.”*

(Manager, Respondent ID#3)

CJ faced many obstacles in its early stages as sourcing refurbished or remanufactured in the context of competitiveness. The obstacles to implementation are that “we compete with how much it costs to throw things away.” However, the importance of understanding the cost estimation of usable products often impedes sourcing. Respondents see this as a key obstacle for organizational learning involving internal and external stakeholders, resulting in marketing CJ as convenient and a new option for transferring materials away from landfills.

#### Convenience:

*“Making it convenient for people to get things to CJ are still things we struggle with as people are still throwing usable materials away as it’s more convenient. The biggest obstacle is getting people not to throw stuff away and getting more people regionally to know we exist.”*

(Executive Director, Respondent ID#1)

While a senior manager expressed a considerable challenge being the design and delivery of services, the logistics manager noted that contractors do not have extra time to create separate waste streams (i.e., landfill vs. reuse) when working at a deconstruction site. Without city or state legislation, the contractors will not separate materials for reuse. Throwing things away and low tipping fees for landfills are primary obstacles as low costs are a primary driver of this industry. The most considerable impact from national and local governments is tipping fees (how much it costs to dump things into a landfill). The lower their costs, the more difficult CJ’s operations are to compete. A senior manager noted that they had indeed imposed new convenience challenges.

#### Convenience and Costs:

*“All of the services we have to offer for free. This is a cost of doing business, yet we have overhead and have to sell enough stuff to cover costs.”*

(Manager, respondent ID#3)

Next, we look at the challenges of pricing for the customers. Pricing starts with and is based on the quality of the material. However, you get into the more challenging areas when handling antiques, and the age of the item and quality of older work makes pricing difficult. This pricing opportunity depends on the quantity and quality of product returns and reverses logistics. In addition, there is uncertainty regarding consumers’ perceptions of circular products. CJ has been in operations for 20 years and still has conversations about this challenge.

#### Pricing:

*“A lot of trial and error for pricing things. Rule of thumb is a like-new or surplus item; you pay half of what they would pay at a big box store.”*

(Executive Director, Respondent ID#1)

In response to our question on awareness of the availability of recycled and refurbishment products, the General Manager noted the importance of education and promoting awareness through the use of pop-up shops inside the facility to communicate the importance of reuse while also helping people with basic homeownership skills. When you advertise that you will take used materials, pick them up and drop them off at no charge, you always obtain people’s junk that is not valuable/reusable. Communicating what materials we do and do not accept is important.

#### Handling materials:

*“We just did a big survey to understand what is people’s knowledge of how to shop for things that are used. There is not a general awareness that rises to the level of used clothing and used cars. So, creating that top-of-mind “shop here first before a big box store” message is challenging.”*

(Manager, Respondent ID#5)

A manager highlighted the importance of project scale. For example, he noted they just received a grant for training and a deconstruction project, yet the red tape involved with the grant prevents it from happening quickly. This is more related to the resistance to adopting new change initiatives and lack of capacity handling capabilities and planning of lay-out redesign.

#### Handling and storing:

*“Because we do not have control over incoming quantity, it makes it difficult for us to supply large projects (i.e., An entire room of materials within a business or home, instead of enough materials for a repair job). This inability to do large-scale projects is a limitation based on the number of incoming materials.”*

(Manager, Respondent ID#3)

We wanted to gauge more information about partnerships with different stakeholders, so we asked about the role and impact of partnerships that CJ has with other regional businesses and organizations and how they are linked to the quantification of circularity benefits. We found they have worked very hard to develop relationships regionally with people in other businesses that would be interested in their materials, such as artists and architects.

CJ has enjoyed considerable success and growth over time. Top management provides training and development initiatives to the employees. Management has been proactive in funding organizational change initiatives for the updates and collaborative partnerships aligned with the evolution of the business model. They have been able to work with organizations such as Goodwill and Goodwill’s labor force. This partnership ended up being a good match for transition, repurposed, disassembly, monitoring for efficiency, help with take-back reverse logistics. It enables CJ to not have to throw away un-shoppable (not easily packaged) products.

Handling, storing, and disposal:

*“We are very labor-intensive. When tile companies donate boxes of products, it’s not in a very shoppable form—looking for and finding an individual’s skill level with the work that needs to be done to make materials shoppable has been a good match for us. Honestly, I cannot afford someone to come in full-time and pay full benefits to. From a material processing approach, I cannot afford a traditional approach to hiring and funding.”*

(Manager, Respondent ID#2)

A crucial element on which managers judged the degree of inter-firm collaboration fit was the perception between governance structures and circularity capability.

Government support:

*“If we are talking about how to move the needle in a significant way, we have to get the design professionals involved. This part with Carnegie Mellon University (CMU) is important because they have to look at reuse first before getting virgin raw materials.”*

(Executive Director, Respondent ID#1)

There is no restriction to the introduction of the events. The relationship with PRC and the work with collection and recycling events has been critical for CJ to get their name out there and get their mission out there so people can consider recycling and reuse. Moreover, CJ welcomes joint activities and collaboration with specific regional companies to learn more about product effectiveness and efficiencies strategies. During this phase of cooperation, efforts focus on increasing network resource interoperability, developing proprietary technology standards, and learning best practices for resource orchestration.

Openness and partnerships:

*“The General Manager added, “along with partnering with specific regional companies that are part of the value chain to promote the specific product at CJ.”*

(General Manager, Respondent ID#2)

The General Manager also noted that a key resource is having open lines of communication with local governments. Examples include the city letting them know when deconstruction projects are coming so CJ can know when material resources are coming and what they need to do to get to these resources and locations.

Government support, openness:

*“We have to get access to jobs and materials through small municipalities in the region.”*

(General Manager, Respondent ID#2)

We found that supply chain management, including material visibility, is vital for identifying inbound materials and developing partnerships to support the business model. To this end, we asked how CJ has been able to locate the suppliers of the recycled/surplus materials. We found that this effort requires a full-time equivalent person at a manager's level. They had to build a web presence—a website and social media. In addition, other efforts were utilized, including word of mouth, creating a portal on the website for making a formal request for CJ to come out and collect people's materials.

Communication and marketing:

*“One of the problems with the industry is that it is decentralized, and there is difficulty in knowing how many are out there. This is important to understand the impact as the number of organizations that reuse or resell materials (clothing and all things like this) is \$18B a year.”*

(Manager, Respondent ID#5)

More recently, this web presence and social media platform has expanded to include people sending in pictures of their materials for the distribution and logistics manager to screen the pictures before deploying resources. CJ keeps track of all of this, quantity, quality, and percentage of material dropped off, picked up, and now runs this through a customer relationship management (CRM) database. These efforts have evolved from “initially being out pounding the pavement, to this now enabling engagement through customers calling CJ and people going to our website.”

Finally, we wanted to know more about how CJ facilitates innovation. Interviewees see several ways they have purposefully approached innovation. Leadership at CJ put much effort into encouraging people to reuse materials in new ways. People shop at CJ (this insight is based on customer survey information) for a specific project or are looking for inspiration. “We do a good job of showing what you can do with a material, (door) not just to walk through, but it could be a table, or made into something else. We provide ideas for how to use things differently.” Many of their customers do not know what they are looking for when they come on-site. Managers and employees address the innovation question by sharing different ways others have used the material. For example, the re-use project puts student designers close to reused materials, producing many unexpected things, e.g., art and functional products. Putting the material in the hands of people who have not had any experience with it can also make new and innovative outcomes. See Figure 4 for a framework that summarizes the success factors that transition a CEBM innovation from an active/strategic entrepreneurship component to a proactive and transformational business model.

Despite the importance of CEBM innovation, the existing literature on this topic in small and medium enterprises lacks focus on the transition from linear to circular systems and is fragmented. The transition framework for CEBM innovation assimilates elements in Figure 4, showing key obstacles and key enablers. This framework summarizes that the organizational transition towards innovation begins with organizational capacities. Organizational capabilities can likewise influence innovation transformation through: (1) Convenience store design; (2) Decisions of Pricing Strategy; (3) Breadth of Services (Re-design for long-life products); (4) Handling, Storing, and Disposal materials; and (5) Government Support and Openness. Our findings identified key enablers. We see these as essential contingency factors requiring an organization to consider broader market perspectives to achieve CEBM innovation.

Several enablers, primarily (1) Material Design and Management Strategies; (2) Benchmark for Services of Product Use Cycle; (3) Resource Management Capabilities; and (4) Marketing Management Communication, can moderate the transition to a CEBM. Understanding the transition process outlined in this case company will help decision-makers and enterprises better collaborate as they co-develop future CE practices. CEBM innovations have emerged as enablers of different production and consumption-related patterns when materials and parts can be recovered during end-of-life processes. The framework

developed in this study offers different types of critical activities necessary for designing and delivering a CEBM.

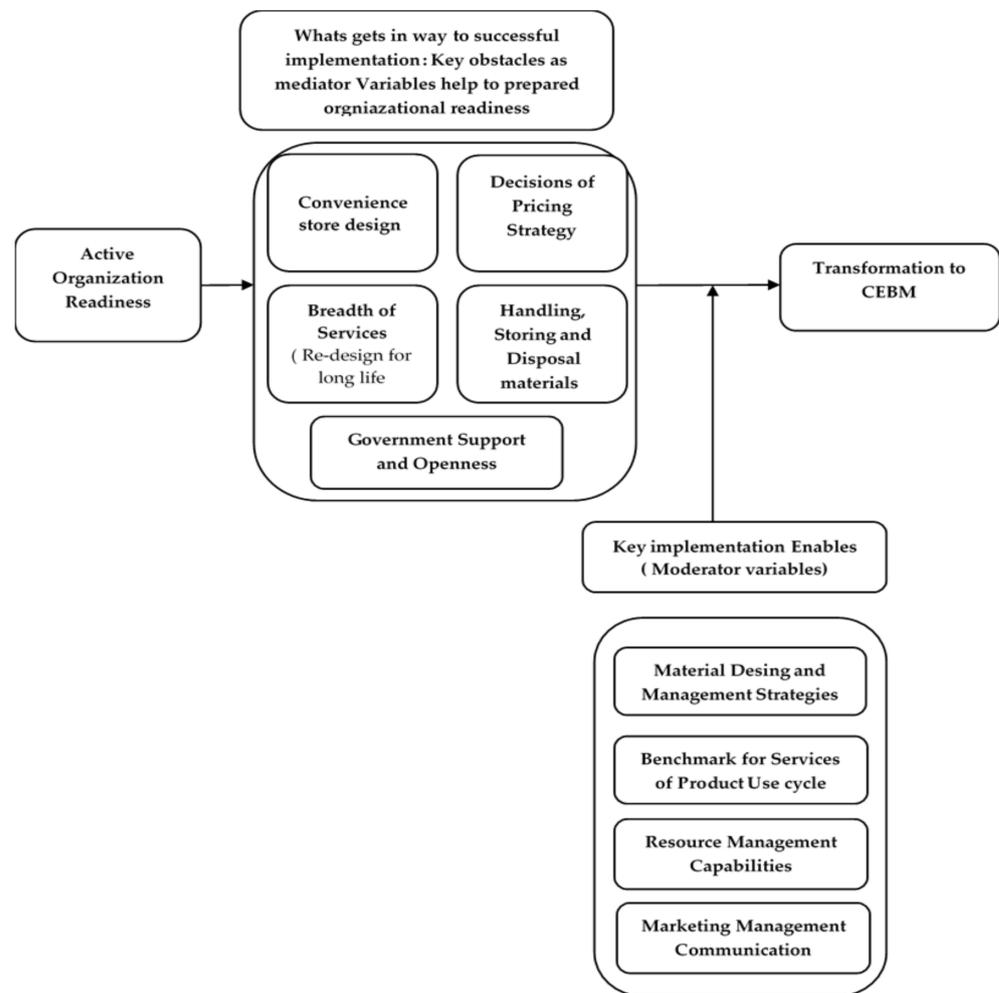


Figure 4. Transitional framework for CEBM innovation.

### 5. Discussion

There is growing research interest in technical and economic elements of sustainability from the perspective of CE. Our findings contribute to the literature and advance the insights on how firms approach changing conditions of the traditional business model into another system under different needs from a material reuse perspective. Based on our findings, we generally agree with [23] that managerial capabilities and competencies such as material management and marketing activities are required to scale a successful CEBM innovation. The Executive Director noted, “We need to figure out ways to recreate material, and how we encourage people to repair, and not to discard it because of color or other issues. This is where an artist or new color can present the material in a new way, i.e., taking a bowling alley floor and making it into a table.” A caveat to this way of thinking is that they have to be careful to evaluate the full value of what can be deconstructed, or salvaged, vs. thrown away. As the Executive Director pointed out, “the big questions to consider regionally and nationally are where are all these vaults of materials going from reconstruction projects and recognizing the emerging trends in this industry?” “We need to think differently from small pieces all the way up to emptying malls and buildings with a lot of materials to find.” An example of thinking differently is reflected in CJ’s community room, which was designed to be deconstructed, so it is easy to take apart and move to any future location. A key example and next phase of thinking are designing things to be

taken apart so people can see working examples of these options as their understanding of taking-make-waste systems change slowly over time. The future vision is to see CJ do more work involving high-performance materials and specialty building products. Respondents to CJ's customer surveys are intrigued by how CJ takes materials that they obtain and can turn them into raw materials for new and other uses. This demonstrates how CJ closes a material loop. Our findings provide novel insights into the success factors that affect the transition of a firm from a traditional economy to a circular economy. Our findings contribute to the literature and advance the insights on how firms approach changing conditions of the traditional business model into another system under different conditions. We find that understanding about the benefits of recycling, collaboration, community engagement; personal selling techniques of recycled products, and management expertise emerge as a success factor for the sustainable transition to circular economy business.

BMI for long-term sustainability necessitates broader and deeper systemic understanding [13]. There has been some progress in developing comprehensive approaches to BMI that are focused on sustainability. Still, there is a long way to go [3]. Our study aligns with [9]'s recent call for more CEBM innovation and transformation research. The bulk of existing research focuses on dynamic capabilities [11] and CE capabilities [101]. The literature offers a limited understanding of the mechanisms underlying the success factors for the transition to CEBMs. As a result of our research, we were able to glimpse the prospects CEBMs present in the U.S., and we hope that this work will enable further research in this area. Our study demonstrates the importance of benchmarking practices. For example, it has been proposed that firms are likely to integrate the best practices from other industries such as services and consumer products [7]. Our findings support this view when the firms benchmark capacity-building initiatives and embrace more automation and digitization in their operations. To this end, firms must adopt a more proactive approach to benchmarking new production technologies. They can actively seek resource-related business prospects outside of their primary operations.

Change management activities should be included in their cycle process to achieve CE-oriented organizational transformation. Regarding material design and product management strategies [15], our findings in this qualitative study support the idea that material design and management strategies allow managers to understand design for durability and design for upgradeability end-use products enabling transformation towards sustainability. For example, Santa-Maria et al. [22] propose that resources and capabilities help implement CEBM innovation. Our study can inform firms of the validity of these connections by identifying resource management capabilities that encourage durability design practices that can lead to planning for future uses of materials [15]. Consequently, we suggest that resource management capabilities act as moderators and increase the implementation of CE initiatives, resulting in CEBM innovation transformation. Moreover, the highlights of our findings show SMEs can design business models according to CE principles. Opportunities await those who can overcome barriers, i.e., community misperception of the high price and low quality of the product (value capture), lack of institutional and government support in capacity building, and lack of necessary space throughout a value chain for reuse activities [114–116]. Recently, Angelis and Feola [116] developed a circular business model using the case study method.

Government support for research and development can not be neglected. Recent research investigating government research and development support under different institutional contextual factors is also essential [117]. Our findings support a conceptual study by [118], which pointed out the importance of government support for the CE. Having shown the key obstacles and capabilities needed for CEBM implementation, our study reinforces the claim for more context-based research on CEs for sustainability. We would hope to see more governmental support in the future by implementing policies for material reuse, recycling and remanufacturing, as this will be valuable to firms for increased resource efficiency and broader adoption of re-use in the economy [95]. Our findings reveal

that government support initiatives can significantly affect the organization's readiness and transition towards CEBM.

Acknowledging the novelty of case study-based contexts such as geographic, cultural specificities, and regional level is necessary to note [119]. The findings show that active participation in reuse activities, cooperation with partner institutions, and developing management expertise and infrastructure are essential factors for firms to transition to CEBMs successfully within the context of sustainability. Planning for and investing in infrastructure that accelerates re-use, repair, and refurbishment can significantly impact the economy by reducing the demand for materials [120]. We find that understanding the benefits of reuse/recycling, collaboration, community engagement, marketing techniques of reused products, and management expertise emerge as a success factor for the sustainable transition to CE businesses. Our findings suggest that collaboration with stakeholders is necessary to improve take-back solutions and facilitate CEBM innovations. A breath of new services is required in the development of CEBMs. Our insights extend research showing that a portfolio of material reuse products has a close relationship with the alignment of management strategies within a value chain [119]. SMEs have to decide whether or when to deploy internal resources and external resources to make a successful transition to a CEBM [16]. Our study extends this line of work by showing how internal organizational alignment facilitates a transition to CEBM innovation.

Finally, the application of CE principles creates several organizational issues [121]. Further, the extant literature on CEBM innovation emphasizes external environmental factors transitioning from a linear to a circular business model [51]. Our finding extends this line of inquiry by highlighting the importance of internal organization barriers, such as developing pricing mechanisms, offering a breadth of new services, and increasing collaboration and communication with the institutional stakeholders. Interestingly, the pricing of virgin materials put small businesses at a disadvantage from the start, making it hard for them to keep a viable business model in place [12]. In line with [118], we find and suggest that developing more promotional programs for awareness and reverse logistics infrastructure through collaboration will help with market expansion. In addition, we recommend that firms provide more training opportunities on material handling to enable new managerial competencies to mitigate knowledge barriers. In doing this, we contribute to a better understanding of the CBMI, which needs more scholarly focus on resource scarcity and global waste streams in both developing and developed countries. Unlike other emerging concepts, the development of successful CE practices is subject to a range of challenges and barriers, all needing further exploration. The idea of the boundary of a system demarcates the limits to the system's components and processes. When applied to the CE, this system boundary concept converts the former linear take-make-waste of virgin material and extends it into a circular, closed-loop material phase in a series of procedures. Simply, the firm's process for collecting end-of-life products from end-users is based on a loop. This process delivers a dynamic value proposition. This closed-loop circular structure can turn traditional linear waste streams into reuse opportunities while creating value from the next use of materials. The CE extends the system's boundary beyond inputs to manufacturing processes to positive impacts on economic development. The transition from linear to a circular economy business model in small and medium enterprises should be a principal concern for management and policymakers when considering the transition's success factors. Small and medium enterprises are the critical linchpin supporting the development of value chain opportunities. Entrepreneurial management competencies and an engaged community will go a long way toward improving any transition's success. Add to this strong collaboration with institutions that can shape and scale the circular business model approach, and the possibilities for CEBMs and a more sustainable future are unlimited.

We also find an opportunity to align the value-creating activities of CBMs with the UN's SDGs. While most entrepreneurs are focused on day-to-day activities, there is an overlooked opportunity for these businesses to map their efforts into global goals to show how

they contribute to sustainable solutions and differentiate themselves from take-make-waste enterprises that are a detriment to the environment. A key contribution is that the proactive role of the firm should not be lost when considering the transition towards proactive and transformational characteristics of entrepreneurship. Moreover, the highlights of our findings that small and medium enterprises can design business models according to the circular economy principles by identifying barriers include lack of community awareness about management and handling of products, community misperception of the high price and low quality of the product, lack of institutional and government support in capacity building, and lack of necessary space throughout a value chain for reuse activities.

### *5.1. Managerial Implications*

This study has practical implications for SMEs operating in the US. CEBMs provide new opportunities for identifying interesting and meaningful relationships that involve the design of critical resources, activities, development of partnership, and value creation activities. While the findings of this particular case study are not generalizable to all situations, results can be generalized to the US context in related SMEs. In addition, the findings provide transferable insight to top management, who are responsible for implementing change initiatives efforts in their organizations. It is important to note that this research aims to draw generalizations about small firms and understand the critical success factors and obstacles influencing the implementation of CEBM that can be operationalized in related environments. The CE and CBM explored in this study help to confirm the need for and value creation opportunities involved in an active and strategic transition to transformational change. Our findings help to demonstrate broader implications and interactions among global goals and local businesses. To this end, we have identified drivers, factors influencing transitions to proactive EBMs, and deep insight into the successful practices of one organization. While CJ does not map their value creation activities into the UN SDGs, their business model does align with global goals as this business model's diversion of materials from traditional waste streams does help Clean Water #6, Decent Work and Economic Growth #8, Industry Innovation #9, Sustainable Cities and Communities #11, along with Responsible Consumption #12, Climate Action #13, Life Below Water #14, and Life on Land #15. Our insights provide opportunities for developing research propositions, additional fieldwork, and the development of constructs, survey items, and measurement models for testing relationships.

First, our findings highlight the following practices for overcoming barriers to a successful transition to the CE model: (1) focus on building a community of material reuse and recycled products users; (2) enable community engagement through social events and increased participation; and (3) use creative processes to enhance the quality of the reused/recycled products and adaptation to local community needs. Next, the case firm differs from a traditional business model as a CEBM innovation by adding new value to CE systems. These transitions in the marketplace require a change in core business practices, and managers need to be aware of the barriers that hinder growth towards a CE. Firms will benefit from enhanced partnerships with regulators, leading to the desired transition towards environmental preservation and sustainability for both businesses and society.

Second, our findings indicate that firms should adopt a circularity-oriented mindset while looking for opportunities to upgrade and refurbish materials. Many of the material barriers to CEBM innovations are physical. To help overcome these barriers, firms should develop more knowledge on how to increase the utilization of products, knowledge of the technology, and knowledge of social and societal trends in product consumption. While dynamic capabilities are widely used to develop CE activities successfully, our study encourages top management to create more training initiatives for capabilities development to keep pace with the continuously changing legislative, technological, and commercial landscape. We acknowledge that SMEs may view CE implementation as problematic due to limited organizational resources. Developing more material reuse or refurbished products

requires increased cooperation between regulators and partners and introducing a breath of services and convenience to create this marketplace.

Finally, despite future resource scarcity predictions, many firms and governments have not fully understood the potential for business model development associated with the CE. Therefore, firms must consider trends in the external resource environment while developing and executing a new breadth of services for material handling strategies to anticipate possible transitions to a more circular economy. Policymakers and governments can look to the United Nation's sustainable development goals to align policy and decision making that enables local, regional, and global goals for more sustainable business models, practices, and economies.

### *5.2. Future Research Direction and Limitations*

The importance of a CBM as a platform for keeping products in a closed-loop is becoming more of a priority for many small and medium-sized enterprises. We depict this necessary transition as a set of phases utilizing an organizational change management context focused on the conditions and forces present in an organization's internal and external environments. In this study, we focus on categorizing the most likely factors to transform CBMs and their dependence on specific external and internal drivers. Our study is not without limitations as we use a case study research approach and data collected from a single material reuse firm in the U.S. According to the findings of this study, the data gathered from a small-medium enterpriser that were not randomly selected from the US, two or three meetings with the majority of the managers involved, and only thirteen days of field observation on the business interaction process are still insufficient. Future research could extend the empirical base to include more small, medium enterprises with various industry backgrounds, particularly in an emerging country perspective, to provide a more holistic understanding of how small-medium enterprises could design CEBM.

Previous studies have already investigated the state of research and avenues ahead in CEBM [16] and ranked the critical success factors in developing country context using decision-making trial and evaluation laboratory (DEMATEL) [91]. Further research studies could use different methodologies, such as fuzzy-AHP and game theory modeling approaches, to analyze individuals' views of specific institutional settings and external collaborations on the investment decisions in the green technologies that facilitate more transition towards CE. The sample and interviews contribute to a limit to the generalizability of the findings as this will require more field study research, larger-scale projects, and cross-industry studies. In locations with greater barriers to proactive and transformational business models that include but are not limited to a lack of awareness of handling materials, lack of collaborative governments and NGOs, low community perceptions of the quality of recycled products, and lack of spaces to store materials for recycling or upcycling, these locations will continue to limit the opportunities for new CBM ventures. The successful outcomes of this study firm would have changed if early funding and business plan development were not available. The continued success of operations would not have been possible without continued community engagement, educational programs, and reuse events, drawing experts, students, and the community together to find innovative and creative uses for materials. The lack of success factors such as these only increases the uncertainties surrounding CBM development. Our findings provide evidence that the CE transition for firms involves several success factors and that entrepreneurs and policymakers should look for and develop these factors. We cannot claim the factors uncovered in this study are comprehensive and are aware that the single firm bias of the case study can limit the generalizability of our findings and look to other scholars to continue this line of research into enabling success factors for a CE, and new insights from CBM innovations.

Second, as we focus on exploring how and why barriers influence transitions towards CEBM, we can gauge the relative importance of sample attributes necessary for generalizing. We are encouraging future quantitative research measuring and weighing the importance of the antecedents of developing CEBM [122]. To build on our findings, future

researchers should validate this conceptual framework in other locations and expand the generalizability of the findings by looking at a diverse set of reuse commodities. We also see research opportunities for in-depth product development practices in reuse/recycling firms. The CBM in this study is one example of a reflexive system of industrial symbiosis. Entrepreneurs can use the waste from the built environment or from one enterprise for reuse in a dynamic CE, with local benefits enabling global progress on multiple UN SDGs. CBMs present new opportunities for the further development of traditional recycling industry enterprises from waste collection to innovative design, upcycling, and closed-loop systems. In the future, these enterprises could eliminate the need for end-of-life landfills and the negative environmental impacts of traditional economic systems.

Third, this study explains how management and related institutional barriers influence CEBM transitions. Major contributors in the CEBM field believed that there is little understanding of how the government supports circular business model transformations [16]. Future studies should also examine the distinct roles of institutions and individual-level elements at various stages of implementing CE initiatives and business models for the global value chain aimed at digital transformation. Several methods could be used to understand the competing interests of different actors in implementing CE strategies in the industry 4.0 environment, such as real options theory and modeling approaches for the adoption of new digital twin tools, such as augmented reality and 3D printing. Finally, The institutional environment affects how entrepreneurs see new business prospects [123]. However, entrepreneurs may impact their institutional contexts, particularly in emerging economies, frequently in change [124]. Our study focused on the single case study that relied on semi-structured interviews to develop a proposed model in Figure 3. This model can be enhanced with further empirical investigation and longitudinal data collection. Longitudinal case studies can be utilized to identify correlations between learning strategies that have no known connection to knowledge integration capabilities that are thought to be influencing the implementation of CEBM innovation. Future research studies could explore contingent factors such as leadership styles and emotions, cognitive beliefs and biases, and internal human resource management practices' effects on the development and transformation of CEBM innovation in both emerging and developed economies. As a result, future studies can broaden this line of reasoning by concentrating on external factors that influence businesses' learning choices and the integration of local and global knowledge. This can include internal factors that influence a firms' choices of CE learning strategies in the digital, artificial intelligence environment. Previous studies have used a single firm case study approach to investigate stakeholder engagement and corporate social responsibility [125] and how luxury products can support a CE [126]. This type of research can support building theory from case studies [127]. Scholars accept using the case study method in researching organizational change design in organizational settings [128]. Dumez [129] highlights the importance of cases that bring out new ideas and re-examine established theories. Case study methodology has been applied in a previous study setting [130]. It helps build a complete understanding of the investigation under study and has a tradition of collecting multiple forms of data. In this study, we use a single intrinsic case. It represents a unique situation of interest to us as researchers to understand better its context within the CE phenomena [106]. The intrinsic case study is not new and has been used by [131] to understand some considerations for implementing recovery support.

### 5.3. Conclusions

The purpose of this research is to use a case study approach to examine how a small-medium enterprise (SME) within the U.S. experienced and made the transition to a CEBM innovation to achieve sustainability. This paper also adds to CEBM innovation by unpacking the concept of upcycling from a sustainability point of view in the sociotechnical system. Achieving widespread acceptance of CE requires including everyone in society's production and consumption patterns in a socio-technological environment, which is why the shift to CE must involve everyone. We have presented a detailed exploratory analysis

of how effectively CEBM innovation can be implemented at small and medium firms. We concluded that production and operational capabilities based on the circularity of materials and products needed to be implemented; however, material design and resource management capabilities are fundamental to achieving sustainability objectives in designing CEBM innovation. The case study results yielded important insights into the obstacles that may hinder value creation and delivery elements of CEBM innovation. Based on our findings, we have proposed that identified obstacles for firms to overcome can act as a mediator if the firms successfully overcome these factors. We expect that (1) Convenience Store Design; (2) Decisions of Pricing Strategy; (3) Breadth of Services (re-design for long-life products); (4) Handling, Storing and Disposing of Materials; and (5) Government Support and Openness context facilitate between the organization readiness for change and CEBM transformation.

The findings of this study show that a firm can develop production and management capabilities and innovations that push it to transition from a traditional business model. The result can be a more circular business model integrating more sustainable business practices. Specifically, we have identified the underlying enablers of how these capabilities affect the transition to a CEBM aligned with sustainable development. This study provides insights into the CEBM innovation process by which enablers can affect the innovation transformation, namely (1) Material Design and Management Strategies; (2) Benchmark for Services of Product Use cycle; (3) Resource Management Capabilities; and (4) Marketing Management Communication. Our findings from this case study demonstrate that collaboration with institutional stakeholders for developing pricing mechanisms, lack of a breadth of services, and lack of capabilities for handling the materials can be understood as part of a possible transition to CEBM.

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## Appendix A

### Interview Protocol

**Interview Protocol** (Modeled from Creswell, 2007)

Circular Economy Practices at Construction Junction (CJ)

Time of interview:

Date:

Place: Construction Junction office/site, Pittsburgh, PA, USA; and follow up by phone

Interviewers: XXXXXX, and YYYYYYY

Interviewees: AAAAAAA, BBBB BBBB, CCCCCC, DDDDDDD

Position of Interviewees: Executive Director of CJ ID#1, General Manager-Chief Operating Office ID#2, Manager of Retail Operations ID#3, Deconstruction Manager ID#4, Donations and Logistics Manager ID#5, Deconstruction Manager ID#6, Community Outreach Coordinator ID#7, Web Communication ID#8, and Board of Directors ID#9–10, Board of Directors President ID#11.

## Questions

1. Can you describe your role at Construction Junction—both how you became involved initially and how your role may have evolved over time?
2. How was the need for this kind of business identified, and by whom?
3. What were the key capabilities and resources for building this business?
4. Could you describe obstacles to implementing the company faced during its inception?
5. Can you speak to the role and impact of partnerships that CJ has with other regional businesses and organizations?
6. How did you identify the suppliers of the recycled/surplus materials?
7. Who approached who?
8. How have customer relations developed/evolved throughout the years?
9. How have your employees contributed to CJ?
10. How does CJ facilitate product innovation?
11. How have national/local government regulations impacted CJ?
12. How have innovations in technology affected the material reuse processes at CJ?
13. Are there any upcoming innovations in technology CJ is looking forward to?
14. How does CJ benefit most significantly from circular economy practices?
15. How have you measured success throughout the development of CJ?
16. What is the critical element or system that is needed for the business to be successful?
17. Can you speak to the company's future outlook in terms of growth/expansion?
18. Who would you name as an exemplary or top-performing CE firm?
19. Is there anything we might have overlooked that you feel is important?
20. Where else should we be looking for further insight?

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