From Sufficiency Principles to Circular Economy Strategies

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ABSTRACT
The ecological crisis, marked by the transgression of planetary boundaries, necessitates a reevaluation of sustainability paradigms, including the integration of sufficiency and circular economy principles. Traditional sustainability models, reliant on technological solutions and market mechanisms, inadequately address the root causes of ecological degradation, such as overconsumption and economic expansion. This research advocates for a paradigm shift toward sufficiency and explores its integration with circular economy practices. Utilizing a review of the literature, we examine how sufficiency drives circular economy. We implement a two-stage search—protocol-driven selection in Web of Science and a qualitative complement focused on recent work—yielding a corpus of 113 articles. From this evidence, we develop a sufficiency-centred framework with three tiers: core pillars (limit setting; operational and normative thresholds; transparency and accountability), implementation guidelines (eco-efficiency and product–service systems under weak sustainability; absolute caps, longevity, repair, and degrowth-aligned metrics under strong sustainability), and outcomes (relative gains with rebound risk versus absolute reductions within planetary limits). The framework clarifies how sufficiency reorients circular strategies from recycling toward preventing demand, extending product lifetimes, and retaining value at higher orders. We conclude with actionable implications for governance and stakeholder engagement, and identify barriers and enablers shaping sufficiency-driven transitions in firms and policy.

Keywords: Sustainability, sufficiency, circular economy, enoughness, ecological economics

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1. Introduction

The current ecological crisis involves the crossing of planetary boundaries. Richardson et al. (2023) report that we have breached six out of nine boundaries, indicating a critical state of Earth's systems. This breach highlights the urgent need to address climate change. Rising global temperatures and extreme weather events have profound socio-economic impacts (Heikkurinen, 2017). Additionally, resource depletion from unsustainable extraction and consumption patterns threatens biodiversity and ecosystem services (Bonnedahl et al., 2022). Sufficiency encourages sustainable consumption and production patterns. It aligns with ecological limits and social equity (Princen, 2005). Integrating sufficiency into business models and policy frameworks is essential for achieving long-term sustainability (Bocken and Short, 2016). This approach aligns with critiques of neoliberalism and calls for ecological justice, as discussed by Salleh (2009). Incremental "weak" sustainability, which depends on technological solutions and market mechanisms, often fails to address the root causes of ecological degradation (Bonnedahl and Heikkurinen, 2019). Transformative strategies that incorporate sufficiency and circularity are necessary to achieve genuine sustainability (Bocken et al., 2022). Sufficiency can redefine prosperity and well-being. It moves beyond efficiency to embrace a holistic understanding of sustainability (Speck and Hasselkuss, 2015).

Sufficiency plays a vital role in sustainable development. Yet, a gap exists in understanding how to integrate sufficiency into circular economy (CE) practices. Current sustainability frameworks often emphasize efficiency and technological solutions. These approaches may overlook the root causes of ecological degradation, such as overconsumption and the pursuit of economic growth (Bonnedahl and Heikkurinen, 2019; Figge et al., 2014). The literature does not fully explore the ethical implications of sufficiency, particularly in business ethics and corporate responsibility (Heikkurinen and Bonnedahl, 2013; Heikkurinen and Mäkinen, 2018). This paper fills the gap by examining the intersection of sufficiency, ethics, and circularity.

This paper explores the research question: Why does sufficiency require a transition to a circular economy in the context of business ethics? The study uses a qualitative approach, drawing on theoretical analysis and case studies to examine how sufficiency

principles integrate into circular economy practices. It examines the limitations of traditional linear economic models. These models prioritize growth and often lead to resource depletion and environmental harm. The paper argues for a shift towards sufficiency-driven circular models (Bonnedahl et al., 2022; Richardson et al., 2023). The research highlights sufficiency's potential to redefine prosperity and well-being. It moves beyond efficiency to embrace a holistic understanding of sustainability (Alcott, 2008; Michaelis et al., 2024).

Business ethics shape organizational values by offering a framework that aligns operations with societal values and expectations. Heikkurinen and Bonnedahl (2013) argue that traditional business strategies, like market and stakeholder orientations, often fail to achieve true sustainability. They suggest adopting a sustainable development orientation that recognizes corporate responsibility. This perspective aligns with Heikkurinen and Mäkinen (2018), who stress the importance of integrating economic, critical, and politico-ethical perspectives. This integration ensures corporate responsibility supports democracy and sustainability.

Ethical considerations significantly influence corporate decision-making, especially in sustainability and resource management. Heikkurinen et al. (2019) propose that extended eco-efficiency and eco-sufficiency strategies drive sustainable change. These strategies improve production quality and reduce production quantity, fostering a culture of responsibility and accountability.

Princen (2005) describe sufficiency as prioritizing material security and ecological integrity over continuous growth. This principle encourages meeting needs without excess. It promotes equitable resource distribution and reduces environmental impact, as discussed by Michaelis et al. (2024).

Sufficiency, rooted in moral philosophy, requires a shift from linear to circular models. Bocken et al. (2022) emphasize integrating sufficiency into circular economy practices to reduce waste and resource use. This approach aligns with Kanschik (2016), who explore the philosophical foundations of sufficiency and support the ethical basis for circular economy practices. These perspectives highlight sufficiency's transformative potential in redefining business ethics and promoting long-term sustainability. Skrbina

(2021) further support this by providing a comprehensive overview of environmental ethics. They emphasize the historical and philosophical development of eco-philosophy and applied eco-ethics.

The main contributions of this article lie in integrating sufficiency ethics with circular economy principles to address ecological crises. This research establishes a conceptual framework that links sufficiency with circularity, highlighting how businesses and policymakers can operationalize sufficiency-driven strategies. Furthermore, it identifies key barriers, ethical dilemmas, and governance challenges in transitioning towards sufficiency-oriented circular systems. By providing theoretical insights and strategic guidelines, the study advances business ethics scholarship and offers a foundation for future empirical research on sufficiency-based sustainability practices.

The remainder of the article is organized as follows. Section 2 details the methodology. Section 3 develops the theoretical foundations of sufficiency. Section 4 outlines the fundamentals of the circular economy. Section 5 presents the sufficiency framework for the circular economy. Section 6 concludes with implications and directions for future research.

2. Methodology

This study adopts a conceptual approach to bridge the research gap in analyzing circular economy policies, focusing specifically on the ethics of sufficiency and sustainable consumption. It aims to understand the policies that foster a circular economy while addressing the ecological crisis and aligning with ecological economics principles. The methodology is a qualitative literature review. Yet, the first step selection of the articles to examine follows a replicable approach, providing a dependable foundation for future academic research.

Figure 1 depicts the article selection.

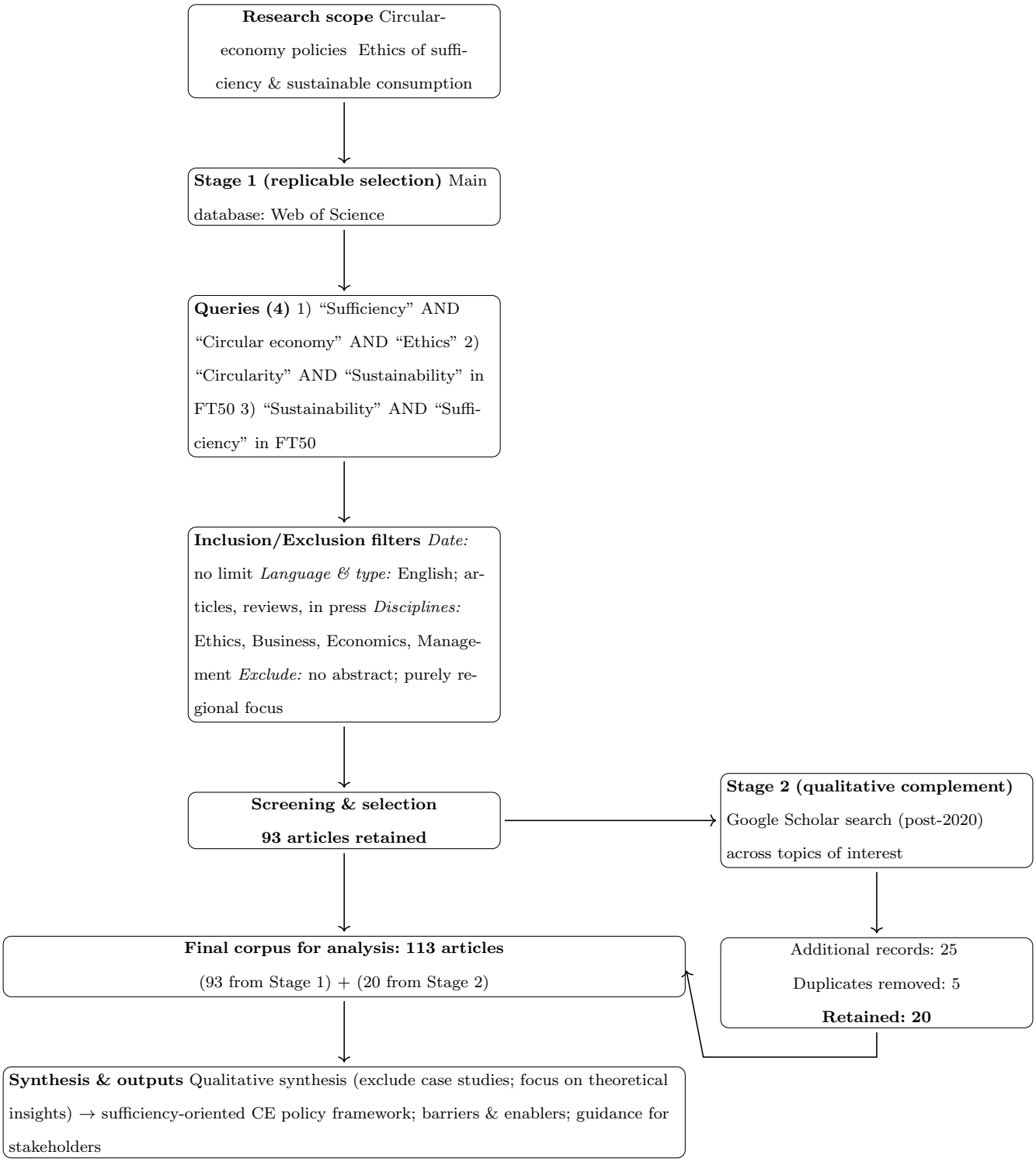


Figure 1. Two-stage literature selection and synthesis workflow

The following criteria were used in the article selection:

(a) **Search Criteria:** We conducted our literature search using the Web of Science database, with four queries. 1) We searched articles that included the terms "Sufficiency" AND "Circular economy" AND "Ethics". 2) We searched "Circularity" AND "Sustainability" in the Financial Times Top 50 (FT50) journal list. 3) We searched "Sustainability" AND "Sufficiency" in the FT50 list. 4) We included all the references from the call for paper. This approach ensured a targeted exploration of the intersection between circular economy and ethical considerations.

(b) **Date Range:** We did not limit our search to a specific date range, allowing for a comprehensive review of the literature across different time periods. This approach enabled us to capture the evolution of thought and practice in the field.

(c) **Language and Type of Publication:** Only journal articles published in English were considered. We included articles, review articles, and articles in press to ensure a broad representation of current academic discourse.

(d) **Disciplinary Focus:** Our analysis was confined to articles published in the fields of Ethics, Business, Economics, or Management. This focus ensured that the research was grounded in relevant academic disciplines.

(e) **Exclusion Criteria:** Articles that did not contribute to the academic conversation, such as those lacking an abstract or focusing solely on regional developments, were excluded. This ensured that the included literature was of high academic quality and relevance.

The first step selection includes 93 articles. The first goal of this research is to structure circular economy policies through the perspective of sufficiency and sustainable consumption (Alcott, 2008; Auxtova et al., 2024). It assesses the effectiveness of different policy instruments while identifying key implementation barriers, including cultural, economic, and regulatory challenges (Baczyk et al., 2024; Baganz et al., 2022). By tackling these obstacles, the study seeks to provide actionable insights to help stakeholders overcome challenges and drive sustainable development forward.

A protocol-driven, replicable search is necessary but not sufficient for a robust re-

view. We therefore added a second-stage, qualitative selection to identify missing or more recent sources that support the article's arguments. In this less formal step, we used Google Scholar to search for publications from 2020 onward across the topics of interest. This yielded 25 additional records, 5 of which were duplicates of the stage-1 set; we thus retained 20 new references. In total, we compiled 113 articles (93 from stage 1 plus 20 from stage 2).

We adopt a qualitative approach, beginning with a comprehensive literature review that establishes the study's foundation by critically examining existing knowledge on circular economy policies (Baldassarre et al., 2024; Bärnthaler and Gough, 2023). The literature review process involves identifying relevant studies through keyword searches, selecting them based on stringent criteria, and synthesizing the information to identify prevailing themes and knowledge gaps. We exclude case studies and focus on theoretical insights from the literature (Bauwens et al., 2020; Benito and Meyer, 2024). We synthesize findings from the literature review and policy evaluation (Beulque et al., 2023; Beyeler and Jaeger-Erben, 2022). This synthesis develops a cohesive policy framework that supports the circular economy, provides clear guidance for stakeholders, and proposes strategies to overcome barriers while leveraging enablers.

3. Theorizing Sufficiency

This section clarifies sufficiency's foundations and shows the differences with traditional sustainability. Eventually, it explains why sufficiency requires a circular economy.

3.1. Defining Sufficiency

Sufficiency embodies the principle of "enough but not too much," focusing on optimal production and consumption. This principle resonates with cultural notions such as the Swedish concept of *lagom*, which emphasizes moderation and balance—"not too little, not too much, just right"—and thus provides a tangible narrative anchor for sufficiency in everyday life (Elf et al., 2020). It challenges traditional growth-centric economic

models by emphasizing the importance of meeting needs without excess (Alcott, 2008; Figge and Thorpe, 2023; Michaelis et al., 2024; Sandberg, 2021). Historically and philosophically, it draws on distributive justice and ecological stewardship, which are crucial for understanding sufficiency's role in promoting sustainable consumption and production patterns (Kanschik, 2016). By aligning with ecological limits and social equity, sufficiency offers a framework for redefining prosperity and well-being, moving beyond mere efficiency to embrace a holistic understanding of sustainability (Jungell-Michelsson and Heikkurinen, 2022; Lage, 2022; Princen, 2005; Speck and Hasselkuss, 2015).

Sufficiency relates to existing concepts in ethics, such as stakeholder theory and resource stewardship (Karimzadeh and Boström, 2024). It aligns with stakeholder theory by prioritizing the needs and well-being of all stakeholders, including future generations and non-human entities (Heikkurinen and Bonnedahl, 2013). The ethical implications of sufficiency in resource stewardship emphasize the moral responsibility to respect planetary boundaries and adopt long-term perspectives (Bonnedahl and Heikkurinen, 2019). Sufficiency can reshape organizational purpose beyond short-term profit, fostering a culture of responsibility and accountability within organizations (Heikkurinen et al., 2019; Niessen and Bocken, 2021; Rudolf and Schmidt, 2025). Philosophically, sufficiency finds support in concepts such as eco-sufficiency and sufficientarianism, which provide an ethical rationale for sustainable practices (Kanschik, 2016). Marketing strategies play a crucial role in promoting sufficiency by encouraging businesses to enable sustainable consumption (Gossen and Kropfeld, 2022; Gossen et al., 2019). The integration of sufficiency in housing, as discussed by Lorek and Spangenberg (2019), has been further explored through concepts like "sufficient home size," highlighting the importance of considering living space and local resource availability in sustainable living (Cohen, 2021).

3.2. Contrasting with Traditional Sustainability

Traditional sustainability frameworks focus on efficiency and technological solutions to support continued growth. They aim to decouple economic growth from environmen-

tal harm (Bonnedahl and Heikkurinen, 2019; Bonnedahl et al., 2022). These methods, however, fail to address the root causes of ecological harm, such as overconsumption and the relentless pursuit of economic expansion (Bocken et al., 2022; Metic and Pigosso, 2022). Market mechanisms and policy frameworks often prioritize economic growth, sacrificing ecological and social well-being (Benito and Meyer, 2024; Richardson et al., 2023).

In contrast, sufficiency redefines prosperity and well-being by challenging traditional assumptions. Sufficiency promotes a holistic view of prosperity that includes well-being, social equity, and ecological integrity, rather than just economic output (Princen, 2005; Speck and Hasselkuss, 2015). It encourages sustainable consumption and production patterns. These align with circular economy principles to minimize resource use and waste (Beulque et al., 2023; Bocken et al., 2022). The ethical implications of sufficiency demand a shift in values toward moderation, restraint, and a focus on long-term ecological and social sustainability (Kanschik, 2016; Princen, 2003). This paradigm shift is crucial for addressing the limitations of traditional sustainability frameworks and achieving genuine sustainability.

3.3. Beyond "Green Growth": Why Sufficiency Demands a Circular Economy

The concept of perpetual economic growth conflicts with the principles of sufficiency, which focus on ecological limits (Alcott, 2008; Michaelis et al., 2024). Traditional economic models emphasize continuous growth. This emphasis often leads to resource depletion and environmental degradation, undermining sustainability goals (Bonnedahl et al., 2022; Richardson et al., 2023). "Green growth" strategies, though well-intentioned, often fail to address the root causes of ecological crises. These strategies can lead to rebound effects, where efficiency gains increase overall consumption (Baczyk et al., 2024; Metic and Pigosso, 2022).

Philosophical and ethical arguments against perpetual growth rely on concepts like eco-sufficiency and distributive justice. These arguments advocate for moderation and restraint in resource use (Kanschik, 2016; Princen, 2005). Consumer behavior signifi-

cantly influences growth-oriented models. This influence underscores the necessity of a cultural shift towards sufficiency (Baczyk et al., 2024).

A circular economy, which eliminates waste and continually uses resources, provides a meaningful alternative to linear resource extraction when guided by sufficiency principles (Murray et al., 2017). Integrating sufficiency into circular models effectively reduces resource throughput. This aligns with ecological limits and promotes sustainable consumption and production patterns (Beulque et al., 2023; Bocken et al., 2022). This approach fosters a culture of moderation and restraint. It addresses the limitations of traditional circular economy initiatives (Bocken et al., 2022; Princen, 2005). Businesses and policy frameworks that emphasize meeting needs without excess demonstrate successful integration of sufficiency into circular strategies (Beyeler and Jaeger-Erben, 2022; Rainville, 2021). Scenarios exploring sustainability strategies, such as those developed for Swedish society, illustrate how alternative systems can prioritize values beyond economic growth (Svenfelt et al., 2019).

4. Circular Economy Fundamentals

This section outlines the core principles of the circular economy, examines its connection to sufficiency, and and discuss its limitations.

4.1. Principles of the Circular Economy

The circular economy is a systemic approach that aims to *eliminate waste and pollution*, *circulate products and materials at their highest value*, and *regenerate natural systems*—in contrast to the linear "take–make–dispose" model (Ellen MacArthur Foundation, 2025; Figge et al., 2022; Murray et al., 2017). A practical way to operationalize these principles is through a set of "R-strategies" that specify how value is retained across prevention, product-level, and material-level interventions. Following established typologies, we present the extended *10R* ladder—*Refuse* (R0), *Rethink* (R1), *Reduce* (R2), *Reuse/Resell* (R3), *Repair* (R4), *Refurbish* (R5), *Remanufacture* (R6), *Repurpose* (R7), *Recycle* (R8), and *Recover* (R9)—which explicitly orders strate-

gies by their typical capacity to preserve utility and embodied value (Agency, 2018; Reike et al., 2018). This ordering is consistent with (but more granular than) the European union waste hierarchy that prioritizes prevention and preparation for re-use over recycling, recovery, and disposal (European Commission, Directorate-General for Environment, 2024).

At a high level, the R-ladder aligns with value-retention *priorities*: (i) **Prevent/avoid flows**—R0–R2 (*refuse, rethink, reduce*) correspond to "narrowing" resource flows through product dematerialization, intensity reduction, and service or sufficiency-based models; (ii) **Preserve product function**—R3–R6 (*reuse, repair, refurbish, remanufacture*) "slow" flows by extending useful life and maintaining function and components; (iii) **Return materials**—R7–R8 (*repurpose, recycle*) "close" loops by directing materials back into production; and (iv) **Last resort**—R9 (*recover*) captures energy recovery from residuals when higher-order options are exhausted (Bocken et al., 2016; Konietzko et al., 2020). In practice, the hierarchy means that, for a given functional need, strategies that *retain product utility* (R3–R6) are generally preferred to material recycling (R8), which in turn is preferred to energy recovery (R9), while *prevention* (R0–R2) is preferred to all downstream options (Agency, 2018; European Commission, Directorate-General for Environment, 2024; Reike et al., 2018).

Design and policy choices should therefore use the R-ladder as a decision aid: design for durability, repairability, and modular upgrade (prioritizing R3–R6); pursue dematerialized or product-service models when they demonstrably *reduce* total demand (R0–R2); and only then rely on high-quality recycling with minimized downcycling (R8) before energy recovery (R9) (Bocken et al., 2016; Konietzko et al., 2020). These priorities also help explain mixed outcomes in practice. For example, product take-back schemes that focus predominantly on recycling may achieve high mass recovery while still losing functional value and triggering rebound, whereas policies that enable repair, refurbishment, and remanufacturing tend to retain more value and reduce primary resource demand (Reike et al., 2018). Sectoral illustrations remain instructive: extended producer responsibility for tyres highlights the difficulty of moving from recovery to durable reuse or remanufacture when upstream design and market incentives

are misaligned; industrial symbiosis for steel-slag valorization and wastewater biogas demonstrates how lower-order options (R7–R9) can be effective only after higher-order options have been exhausted (Campbell-Johnston et al., 2020; Falsafi and Fornasiero, 2022; Junior et al., 2021).

Finally, the extended R-ladder complements business-model strategy sets that "*narrow, slow, close, and regenerate*" resource loops. Firms can map offerings and policies to the ladder to prioritize value retention, check for problem shifting, and align with sufficiency (e.g., refusing superfluous functionality, designing for long life, and enabling repair before recycling) (Bocken et al., 2016; Konietzko et al., 2020).

4.2. Linking Circularity to Sufficiency

Integrating circularity with sufficiency is essential to prevent unsustainable consumption patterns. The circular economy aims to close material loops. However, without sufficiency principles, it may inadvertently increase consumption (Bocken et al., 2022). Efficiency gains can lead to rebound effects, where overall consumption rises, undermining sustainability goals (Baczyk et al., 2024; Metic and Pigosso, 2022). Consumer behavior significantly influences circular business models. Without a sufficiency mindset, these models may not reduce resource use (Baczyk et al., 2024). The fashion industry illustrates this issue. Circular practices like recycling and reuse can still lead to overconsumption without focusing on sufficiency (Auxtova et al., 2024). In this context, the fashion industry's shift towards digital transformation and circular economy models is vital (Colombi and D'Itria, 2023; Garcia-Ortega et al., 2023).

Sufficiency-minded circular approaches actively limit resource throughput by prioritizing needs within ecological limits. These approaches complement circular economy strategies (Alcott, 2008; Michaelis et al., 2024). Integrating sufficiency into circular business models minimizes resource use and aligns it with ecological boundaries (Bocken and Short, 2016). A sufficiency-based circular economy combines reducing, reusing, and recycling to achieve sustainable consumption patterns (Bocken et al., 2022). Businesses that implement sufficiency-driven circular models successfully demonstrate the feasibility and benefits of this approach (Beyeler and Jaeger-Erben,

2022). Sufficiency addresses the limitations of traditional circular economy practices by fostering a culture of moderation and restraint in consumption (Princen, 2005).

4.3. Limitations

Several limitations are inherent to the circular economy and its implementation (Corvellec et al., 2022; Korhonen et al., 2018):

- Thermo-dynamic limits: CE strategies cannot fully overcome the laws of thermodynamics, such as entropy increase and energy dissipation. For instance, recycling processes inevitably lead to material degradation and require additional energy inputs, preventing perfect closure of material loops (Cooper et al., 2017; Stephan, 2022).
- System boundaries and scale issues: CE often focuses on micro-level (e.g., product) or meso-level (e.g., firm) interventions, neglecting macro-level systemic effects like global supply chains and unintended environmental shifts (Korhonen et al., 2018).
- Economic and implementation barriers: High upfront costs, lack of incentives, and structural obstacles (e.g., market failures) hinder widespread adoption, particularly in resource-intensive industries (Corvellec et al., 2022).
- Rebound and behavioral effects: As noted earlier, efficiency gains can paradoxically increase consumption, offsetting environmental benefits (Alcott, 2008; Figge and Thorpe, 2023; Figge et al., 2014).
- Managerial resistance arises from conflicts between profit-growth metrics and sufficiency values (Alcott, 2008; Michaelis et al., 2024). Overcoming shareholder pressures requires leadership, redefined key performance indicators (Bocken and Short, 2016), and education (Baldassarre et al., 2024).
- Policy frameworks often prioritize growth over sustainability, reinforcing linear models (Benito and Meyer, 2024; Mazahir et al., 2019). Misaligned subsidies hinder sufficiency (Ignat et al., 2024). Integrating sufficiency into regulations and narratives (Borrello et al., 2023; Callmer and Bradley, 2021) supports circular transitions (Persson and Klintman, 2022; Rainville, 2021).

Furthermore, the CE is a culturally and socially constructed concept that is dynamic and evolves over time (Callmer and Bradley, 2021; Deutz et al., 2024; Pál, 2022). Originating from industrial ecology and cradle-to-cradle principles, it has been shaped by Western economic paradigms but varies across cultural contexts—e.g., emphasizing community-based sharing in some societies versus technological innovation in others (Rajčić et al., 2025). This dynamism means CE must adapt to changing social norms, such as shifting consumer values toward minimalism or equity. However, the manuscript's prior discussion insufficiently addressed these aspects; current implementations often overlook social inequalities, cultural resistance to reuse, and the need for inclusive policies that account for diverse societal contexts (Iofrida et al., 2024; Zavos et al., 2024). Integrating social solidarity economy (SSE) principles can help bridge these gaps, fostering equitable transitions (Pál, 2022).

Consumer behavior significantly influences the success of circular business models. A sufficiency mindset is essential for these initiatives to reduce overall resource use (Baczyk et al., 2024). Studies show that circular economy practices can inadvertently increase consumption. For instance, aquaponics in urban settings like Berlin may not fully address broader issues of resource use and sustainability. This situation highlights the need for a more comprehensive approach (Baganz et al., 2022). This need aligns with the argument that sufficiency-oriented concepts can effectively transform consumption patterns (Suski et al., 2023).

To achieve more than efficiency gains, we require moral guidance through sufficiency principles. Integrating these principles into circular economy practices minimizes resource use and aligns it with ecological boundaries (Bocken et al., 2022). Sufficiency encourages sustainable consumption patterns by prioritizing needs within ecological limits instead of maximizing consumption (Michaelis et al., 2024; Princen, 2005).

5. A Sufficiency Framework for the Circular Economy

This section describes the core pillars of the framework and the strategic and practical guidelines. Eventually, it presents the diagram of the sufficiency framework.

5.1. Core Pillars of the Framework

The core pillars of a sufficiency-oriented framework guide the transition toward sustainable resource use and consumption patterns. Limit setting serves as a fundamental component, establishing operational and normative thresholds to prevent ecological overshoot. Richardson et al. (2023) highlight the critical state of Earth's systems and emphasize the need for clear boundaries to maintain ecological integrity. Bärnthaler and Gough (2023) elaborate on sufficiency, defining it as the space between meeting essential needs and avoiding excess, which is key for sustainable production and consumption. This concept aligns with the notion of living well within limits. Fuchs (2019) discuss the challenges of overconsumption and the need for structural changes. Spengler (2016) explore this dual focus on minimum and maximum thresholds, arguing that both are integral to achieving sustainability.

Operational thresholds guide business practices and policy decisions, ensuring resource use stays within sustainable limits (Bonnedahl et al., 2022; Lehtonen and Heikkurinen, 2022). These thresholds enable organizations to align operations with ecological boundaries, promoting long-term sustainability. Normative thresholds play a crucial role in shaping societal values and expectations regarding consumption and production. Princen (2003) and Speck and Hasselkuss (2015) highlight the importance of a cultural shift toward moderation and restraint. They advocate for a society that values sufficiency over excess.

Transparency and accountability play crucial roles in ensuring ethical oversight in production and consumption cycles. Bocken et al. (2022) and Rainville (2021) emphasize the importance of stakeholder engagement and collaboration. These elements foster a culture of accountability, where each party remains informed and responsible for its actions. This collaborative approach is essential for achieving sustainability outcomes and upholding sufficiency values.

5.2. Strategic and Practical Guidelines

To translate the ethical case into practice, we distinguish between *weak* and *strong* sustainability interpretations (Ekins et al., 2003; Zagonari, 2024). Under a weak-sustainability reading (where natural and manufactured capital are viewed as largely substitutable), circular strategies prioritize eco-efficiency and decoupling. In this space, product–service systems (PSS) shift the focus from ownership to access and can deliver higher utilization, maintenance, and repair services (Roman et al., 2023), complementing sufficiency-driven business models that extend product lifetimes and temper demand (Bocken and Short, 2016); however, PSS alone are not a guarantee of absolute decoupling (Kjær et al., 2019).

Under a strong-sustainability reading (where critical natural capital is non-substitutable and absolute ecological limits are binding) (Ekins et al., 2003), sufficiency and degrowth-aligned aims become central. Accordingly, we propose adopting degrowth-based metrics alongside conventional indicators to evaluate whether practices deliver *absolute* reductions in throughput, not merely relative efficiency gains (Hickel, 2021; Hickel and Kallis, 2020; O'Neill et al., 2018). This requires clearly distinguishing efficiency, sufficiency, and consistency strategies in assessment and design (Rudolf and Schmidt, 2025), and foregrounding sufficiency as a social practice—i.e., routine actions that systematically use fewer resources (Speck and Hasselkuss, 2015). In operational terms, this implies (i) designing PSS and local supply chains to cap demand and prioritize longevity and repair over throughput; (ii) setting absolute resource-use and waste targets consistent with planetary limits; and (iii) using degrowth-oriented indicators to track progress toward meeting needs within ecological boundaries.

Local supply chains significantly support sufficiency and circularity by reducing transportation emissions and fostering regional self-sufficiency. Sandstrom et al. (2024) explore the potential of replacing imported feeds with domestic byproducts to enhance food system resilience. Moggi and Dameri (2021) illustrate the success of the local circular ecosystem RiCibo in Genoa, Italy. This success aligns with the diverse business models identified by Donner and de Vries (2023), which emphasize collaborative ap-

proaches and sustainability visions in agri-food systems. Integrating sufficiency principles into business models drives innovation and creates sustainable value, as shown by Beyeler and Jaeger-Erben (2022) and Beulque et al. (2023). Challenges include stakeholder resistance to growth-oriented models, as noted by Baczyk et al. (2024). Leadership development and education play a crucial role in embedding sufficiency into organizational culture.

5.3. Diagram of the Sufficiency Framework

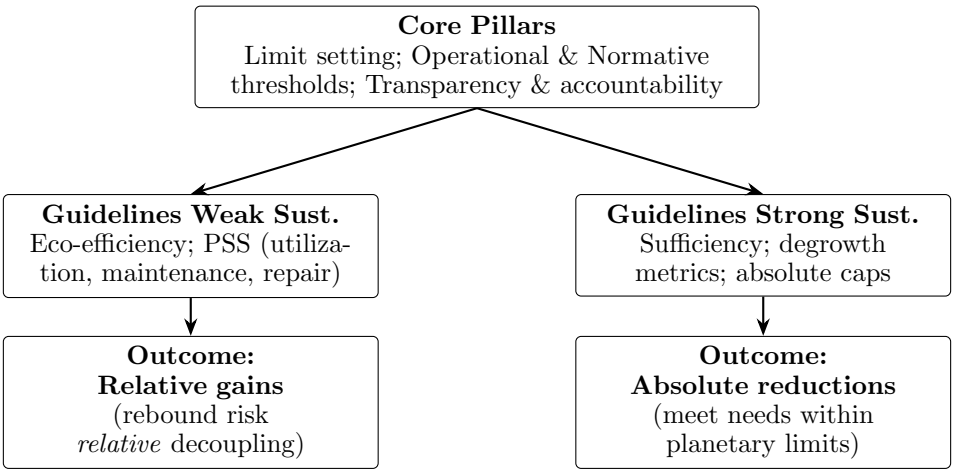


Figure 2. Conceptual framework: *Core pillars* inform *weak* vs. *strong* guidelines, yielding *relative gains* vs. *absolute reductions*.

Figure 2 synthesizes the argument of Section 5 into three tiers—Core pillars → Guidelines (weak vs. strong) → Outcomes. It clarifies the directional logic from foundations to effects.

The Core pillars are prerequisites. The upper box aggregates the enabling conditions of a sufficiency-oriented circular economy: (i) limit setting, and within it (ii) operational and (iii) normative thresholds, plus (iv) transparency & accountability. Together these pillars translate planetary and social boundaries into expectations, rules, and oversight mechanisms that constrain design and behavior (Bärnthaler and Gough, 2023; Bonnedahl et al., 2022; Fuchs, 2019; Lehtonen and Heikkurinen, 2022; Richardson et al., 2023; Spengler, 2016). Arrows from this box indicate directional dependence (not causal identification): guidelines should be read as valid only when

anchored in these pillars.

There are two possible guidelines for implementation. The diagram branches into two guideline tracks that differ in their core assumption about substitutability. The weak track (left) treats natural and manufactured capital as largely substitutable and therefore emphasizes eco-efficiency and product–service systems to raise utilization, maintenance, and repair (Roman et al., 2023). This track can deliver important relative improvements but, as noted in the text, PSS alone do not guarantee absolute decoupling (Kjær et al., 2019). The strong track (right) assumes critical natural capital is non-substitutable and limits are binding (Ekins et al., 2003). It therefore foregrounds sufficiency as a social practice, explicit absolute caps (resources and waste), and degrowth-oriented indicators to assess whether throughput is actually reduced rather than merely made more efficient (Hickel, 2021; Hickel and Kallis, 2020; Rudolf and Schmidt, 2025; Speck and Hasselkuss, 2015).

Two distinct outcome depend on the chosen guideline. Because the weak track optimizes efficiency under substitutability, the expected outcome is relative gains with a potential for rebound (left). By contrast, the strong track targets absolute reductions in material and energy throughput while meeting needs within planetary limits (right). This outcome requires making limits explicit (caps), designing for longevity and repair, and tracking progress with metrics aligned to absolute boundaries rather than intensity ratios (Hickel, 2021; O'Neill et al., 2018).

6. Conclusions, Implications, and Future Research

This section concludes the article, and discusses the policy implications and future research possibilities.

6.1. Conclusions

This study explores the need to integrate an ethic of sufficiency with a circular economy approach to address ecological crises. A comprehensive literature review and theoretical analysis highlight the limitations of traditional growth-centric models. The research

shows sufficiency's potential to redefine prosperity and well-being. The main contributions clarify how sufficiency drives transformative change in sustainability practices. The findings suggest that sufficiency-driven circular models effectively reduce resource throughput, align with ecological boundaries, and promote sustainable consumption and production. The integration of sufficiency principles into circular economy practices ensures that resource use is minimized and aligned with ecological limits, fostering a culture of moderation and restraint.

These findings profoundly impact management and policy formulation. Businesses can integrate sufficiency principles into strategic planning to foster innovation and create sustainable value. This approach shifts the focus from short-term financial gains to long-term ecological and social goals. Policymakers should prioritize sufficiency over traditional growth models. They can set clear limits on resource use and promote sustainable consumption patterns. International agreements and policy reforms play a crucial role in fostering global commitment to sufficiency-based circular systems. These systems address transnational challenges like climate change and resource depletion. Aligning national policies with international agreements enhances coherence and effectiveness in promoting sufficiency and circularity. This alignment supports the transition to a more sustainable and equitable future.

Sufficiency-driven circular models offer promising potential, yet this study identifies several limitations. The research's theoretical nature requires empirical validation. Researchers should conduct case studies and longitudinal research to evaluate the long-term impacts of adopting sufficiency. Cultural differences in perceiving and implementing sufficiency principles require further exploration. This exploration will help understand diverse pathways and strategies for global implementation. Future research should examine the role of disruptive technologies, such as blockchain, in reinforcing ethical circularity. Blockchain can enhance transparency and traceability in supply chains. Interdisciplinary research that bridges ethics, economics, and ecology is crucial. This research will help develop comprehensive frameworks for sufficiency-driven circular transitions. It ensures that technological advancements contribute to genuine sustainability. Addressing these limitations will allow future research to provide valu-

able insights. These insights will aid in the practical application of sufficiency principles and their potential to drive transformative change in sustainability practices.

6.2. Policy Implications

In pursuing sufficiency-based circular systems, policy reforms and international agreements hold a crucial role. Callmer and Bradley (2021) emphasize the need for policies that prioritize sufficiency over traditional growth models. They advocate for setting environmental limits and promoting sustainable consumption. This perspective aligns with Persson and Klintman (2022), who argue that sufficiency should complement efficiency in environmental policymaking to reduce consumption levels. International agreements foster global commitment to sufficiency-based systems and address challenges like climate change and resource depletion (Benito and Meyer, 2024; Javier Llorente-Gonzalez and Vence, 2019). Integrating sufficiency principles into frameworks like the Sustainable Development Goals enhances their effectiveness in promoting sustainability (Rainville, 2021; Valverde and Aviles-Palacios, 2021). Aligning national policies with international agreements ensures coherence and effectiveness in promoting sufficiency and circularity (Benito and Meyer, 2024; Mazahir et al., 2019). The Level(s) framework, as discussed by Diaz-Lopez et al. (2021), provides a structured approach to integrating circular economy principles into building practices, supporting these policy goals.

Interdisciplinary collaboration creates broader governance solutions. Bocken et al. (2022) and Metic and Pigosso (2022) emphasize the importance of integrating insights from ethics, economics, and ecology to develop comprehensive governance strategies. Collaborative governance encourages a shared commitment to sufficiency values and involves diverse stakeholders (Patala et al., 2022; Villalba-Eguiluz et al., 2023). Interdisciplinary research informs policy development by providing evidence-based insights into sufficiency-oriented strategies (Bocken and Short, 2016; Lehtonen and Heikkurinen, 2022). Effective communication and coordination among stakeholders with diverse perspectives are necessary to foster such collaborations (Bocken et al., 2022; Metic and Pigosso, 2022).

6.3. Future Research

To advance the discourse on sufficiency and the circular economy, researchers should conduct cross-cultural and longitudinal studies to assess the long-term impacts of sufficiency adoption. Understanding cultural differences in how people perceive and implement sufficiency principles is essential. These differences significantly influence the success of strategies driven by sufficiency (Rovanto and Finne, 2023). Longitudinal studies assess the sustainability and resilience of sufficiency practices over time. They provide insights into the long-term viability and impact on ecological and social systems (Beyeler and Jaeger-Erben, 2022). Cross-cultural research reveals diverse pathways and strategies for adopting sufficiency. It offers valuable lessons for global implementation (Niessen et al., 2023).

Exploring disruptive technologies, such as blockchain, offers a promising direction for reinforcing ethical circularity. Blockchain technology enhances transparency and traceability in supply chains. It supports ethical circular economy practices by ensuring accountability and reducing fraud (Baldassarre et al., 2024). Digital technologies facilitate consumer engagement and promote sufficiency-oriented behaviors through platforms that encourage sharing and reuse (Samani, 2025). Emerging technologies address challenges in circular economy implementation. They improve resource efficiency and reduce waste while aligning with sufficiency principles (Schipfer et al., 2024). Interdisciplinary research explores the integration of disruptive technologies with sufficiency and circular economy frameworks. This integration ensures that technological advancements contribute to genuine sustainability (Bocken et al., 2022). Integrating used electrical vehicle batteries into the circular economy exemplifies innovative approaches to resource efficiency and sustainability (Obrecht et al., 2022). Understanding the context factors of transdisciplinary projects enhances these efforts by tailoring strategies to specific regional needs and resources (Parli et al., 2024).

Compliance with Ethical Standards

There are no known conflicts of interest in preparing the content of the paper. The research does not involve any subjects of any kind. There was no informed consent obtained since no participant was involved in this research. Consequently there is no need for the obtention of informed consent.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work the authors used ChatGPT in order to help writing the article. After using this tool/service, the authors reviewed and edited the content as needed and takes full responsibility for the content of the publication.

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