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Reframing Household Waste within Supply Chain Systems: A Systematic Review and Conceptual Framework

Tedarik Zinciri Sistemleri İçinde Hanehalkı Atıklarının Yeniden Çerçevelenmesi: Sistematik Bir Derleme ve Kavramsal Çerçeve

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Abstract: According to the United Nations Environment Programme, global municipal solid waste generation reached approximately 2.3 billion tons in 2023, a significant share of which originates from households. In parallel, the growing emphasis on circular economy (CE) practices has highlighted household waste as a critical resource within supply chain systems. This paper consolidates the state of the art research on household waste supply chain management. The purpose of this study is to systematically synthesize this literature by adopting a process-based supply chain management (SCM) perspective. Using a content-analysis based systematic literature review approach, 493 peer-reviewed journal articles retrieved from the Web of Science database published between 2015 and 2025 were analyzed. The findings identify the dominant research streams associated with major SCM processes, from which a household waste supply chain framework integrating CE principles with established SCM processes is proposed. This study provides insights that are particularly relevant for countries facing increasing household waste generation and offers a structured foundation for future research and policy development.

Keywords: Household Waste Supply Chain Management, Circular Economy, Waste Logistics, Returns Management, Systematic Literature Review

JEL Classification: M11, Q53, Q56

Öz: Birleşmiş Milletler Çevre Programı verilerine göre, dünya genelinde katı atık üretimi 2023 yılı itibarıyla yaklaşık 2,3 milyar tona ulaşmış olup, bu atıkların önemli bir bölümü hanehalkı kaynaklıdır. Döngüsel ekonomi uygulamalarının giderek artan önemi ise hanehalkı atıklarını tedarik zinciri sistemleri içerisinde kritik bir kaynak olarak öne çıkarmıştır. Bu çalışma, hanehalkı atık tedarik zinciri yönetimi alanındaki literatürü bütüncül bir biçimde ele almaktadır. Çalışma, süreç temelli bir tedarik zinciri yönetimi bakış açısı benimseyerek bu literatürü sistematik olarak sentezlemeyi amaçlamaktadır. Bu doğrultuda içerik analizi temelli sistematik literatür incelemesi yaklaşımı kullanılarak Web of Science veri tabanından elde edilen 2015–2025 yılları arasında yayımlanmış 493 hakemli dergi makalesi analiz edilmiştir. Bulgular, temel tedarik zinciri yönetimi süreçleriyle ilişkili baskın araştırma akımlarının belirlenmesine katkı sağlamış olup ilgili süreçlerle döngüsel ekonomi ilkelerini bütünleştiren bir hanehalkı atık tedarik zinciri çerçevesi önerilmiştir. Çalışma, hanehalkı atık oluşumunun giderek arttığı ülkeler açısından özellikle önem taşıyan çıkarımlar sunmakta ve gelecekteki araştırmalar ile politika geliştirme süreçleri için yapılandırılmış bir temel oluşturmaktadır.

Anahtar kelimeler: Hanehalkı Atık Tedarik Zinciri Yönetimi, Döngüsel Ekonomi, Atık Lojistiği, İade Yönetimi, Sistematik Literatür İncelemesi

JEL Sınıflandırması: M11, Q53, Q56

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1. Introduction

Recent global disruptions such as COVID-19 pandemic along with shocks to energy and resource supplies have reshaped household consumption patterns and waste generation pushing household waste flows to the center of sustainability debates (UNEP 2024). These changes have intensified the pressure on existing waste management systems and highlighted the strategic role of household waste within broader supply chain structures. Recent studies emphasize the increasing importance of household-generated food, plastic, and medical waste, alongside growing behavioral and institutional challenges in managing these flows (Ananda et al. 2024; Hu et al. 2024; Madden and Florin 2024; Mavlutova et al. 2023). In this context, waste management has emerged as a critical component of the reverse logistics and has been widely studied both in developing and developed countries (Batista et al. 2018; González-Sánchez et al. 2020). Growing scholarly interest in reverse logistics with a focus on waste supply chain activities has resulted in a broader examination of waste management practices. However, the rapid shifts triggered by recent global developments have also revealed the need for further investigation of innovative waste management practices (Popa et al. 2024; Rogowska et al. 2024).

Circular economy (CE) thinking has emerged as a dominant paradigm in addressing these challenges by fundamentally reconfiguring how physical resources are perceived, created, managed, and configured in current economic systems (Geissdoerfer et al. 2017). To enhance circularity, resource loops must be narrowed, slowed, or closed (Bocken et al. 2016), a transformation that is often operationalized through so-called “R” frameworks such as reduce, reuse, recycle, and recover (Kirchherr et al. 2017). Recent household-focused studies increasingly tend to frame food waste, packaging waste, textile waste, and e-waste as critical leverage points for advancing CE objectives at the urban and municipal level (Yu et al. 2022; Koshta et al. 2024; Tam and Anh 2024). Within this perspective, household waste is no longer viewed only as an end-of-life output but rather as a valuable resource stream contributing to circular supply chains (CSCs) (Jain et al. 2018). Emerging digital and organizational solutions, including blockchain-based incentive systems and smart collection infrastructures, further support this transition (Saeedi 2024).

In this context, the concept of CSCs provides a useful analytical lens by emphasizing the preservation of value through reverse flows, extended actor networks, and collaborative relationships. CSCs typically involve a larger number of stakeholders and more complex interaction patterns compared to linear supply chains, thereby creating new coordination and governance challenges (Bressanelli et al. 2019). Performance objectives in CSCs increasingly depend on effective integration across value chain actors, highlighting the importance of

collaboration, information sharing, and inter-organizational alignment (Jain et al. 2018; Farooque et al. 2019; Lahane et al. 2020; Saeedi 2024).

Supply chain management (SCM) literature offers well-established frameworks for understanding supply chain dynamics and interdependencies. Early contributions by Cooper et al. (1997) conceptualized SCM through the interaction of business processes, supply chain structure, and management components. Building on this foundation, Lambert and Cooper (2000) identified key business processes in SCM, which were later revised to reflect developments in research and practice (Lambert and Enz 2017). Despite their analytical strength, these frameworks are primarily rooted in linear supply chain logic. Recent household waste studies increasingly call for integrating waste collection, sorting, recycling, and redistribution processes into broader SCM frameworks to better reflect CSC realities (Farooque et al. 2019; Nguyen et al. 2024). Consequently, an important research gap remains regarding how these SCM process frameworks can be adapted and extended to capture the dynamics of circular and household waste-oriented supply chains. Motivated by these gaps, the purpose of this study is to develop a comprehensive framework for household waste supply chains (HWSCs) from a CE perspective. By systematically reviewing the existing literature, the study aims to identify dominant research domains, map household waste-related processes onto established SCM frameworks, and highlight understudied areas for future research. To operationalize this purpose, the study addresses the following research questions:

1) What are the main domains of research in HWSCs with respect to established SCM process frameworks?

2) Which future research topics need to be addressed to enhance circularity through HWSCs?

The remainder of the paper is structured as follows. The next section outlines the research methodology and systematic literature review (SLR) process, followed by descriptive and thematic analyses, the development of a HWSC framework, and a discussion of key findings and future research directions.

2. Systematic Literature Review

Considering the discovery-oriented nature of research questions, and the aim to combine two different research streams, SLR was selected as the method to synthesize and structure the existing body of knowledge on HWSCs. SLR is a widely used method in SCM research (Seuring and Muller 2008) because it allows existing patterns and topics in a certain field to be summarized, and also is suitable for the application of thematic analysis with respect to emergent or pre-defined categories. Following established guidelines for conducting rigorous

SLRs in SCM research, this study is designed to ensure transparency, replicability, and analytical rigor throughout the review process.

2.1. Research Design

The methodological approach of this study is grounded in the SLR procedures proposed by Seuring and Müller (2008) and further refined by Seuring and Gold (2012) and reported in a PRISMA-informed manner (Page et al. 2021) to ensure transparency and replicability of the literature identification and screening stages. These approaches emphasize a structured and rule-based review process supported by qualitative content analysis. Accordingly, the review process consists of four main stages: (i) literature identification, (ii) inclusion and exclusion screening, (iii) coding and categorization, and (iv) synthesis and framework development.

2.2. Data Collection

The SLR is conducted based on the following steps: (i) selection of the database, (ii) identification of the keywords, (iii) selection of the related articles and defining exclusion criteria, (iv) data evaluation (Khan et al. 2003). This study further applies the content analytic approach described by Seuring and Gold (2012).

i) Selection of the database

Web of Science database was limited to the period between January 2015 and January 2025, covering the years in which scholarly interest in household waste, CE, and SCM this time frame allows capturing both the early conceptualization of household waste within CE discussions and the more recent process-oriented and supply chain-focused studies.

ii) Identification of the keywords

The keywords were searched in two steps; (a) waste AND circular AND household (b) waste AND “supply chain” AND household (c) waste AND logistics AND household.

These keyword combinations were selected to ensure a comprehensive coverage of studies addressing household waste from CE, SCM, and logistics perspectives, while avoiding an overly broad inclusion of studies unrelated to household-generated waste.

iii) Selection of the related articles and defining exclusion criteria

The database is limited to articles in English. Search criteria were compared with “or” command to remove duplications, and the search returned 901 articles. The distribution of the articles per year involved in the study is represented in Figure 1.

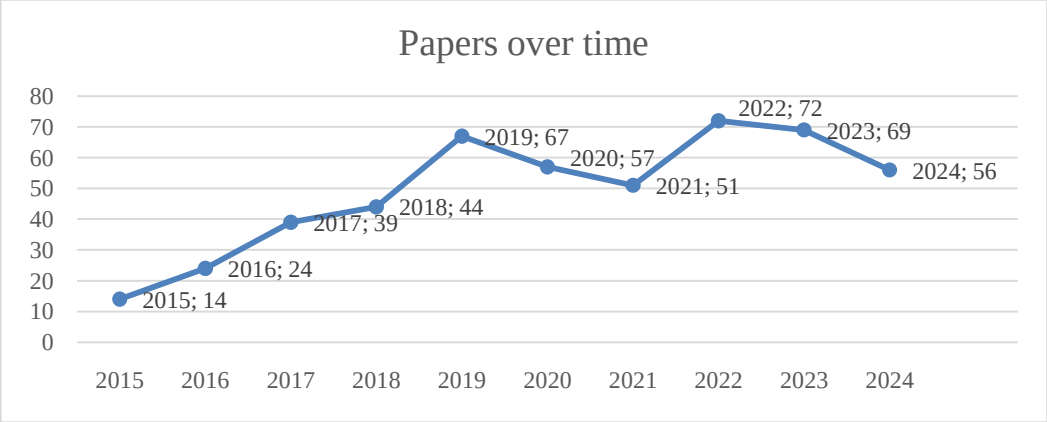


Figure 1. Distribution of the articles per year

Source: Created by the authors

At the very beginning of the study, the criteria included articles, book chapters and abstract-only access papers. The search included only articles published in English, and non-English publications were excluded during early screening stage. The search terms included the keyword “waste”; however, some results referred to unrelated uses of the term, such as “child waste,” or to studies focusing on general health conditions not linked to household consumption. Accordingly, these articles were excluded from the final dataset. Another key inclusion criterion was that the source of waste originated from households. Accordingly, articles addressing waste sources other than household consumption such as industrial or exclusively commercial waste streams were excluded from the final evaluation. After all inclusion and exclusion criteria were applied, the final sample comprised of 493 household waste–related articles included in the overall analysis (Figure 2).

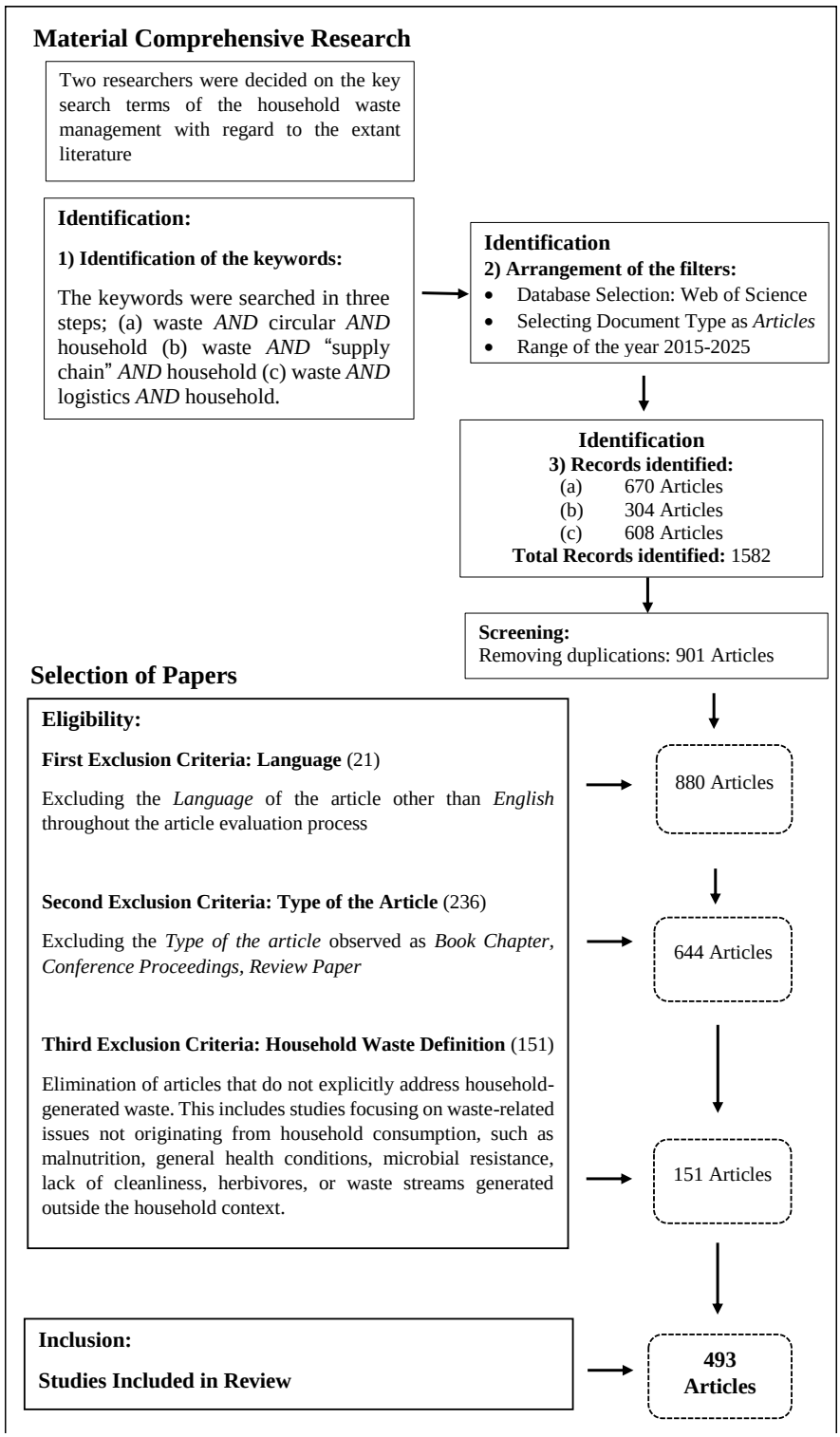


Figure 2. PRISMA-informed flow diagram

Source: Created by the authors

iv) Data Evaluation

Data was extracted by categorizing different research focuses and grouped according to predefined and emergent analytical categories. Following the content analysis principles

suggested by Seuring and Gold (2012), a structured coding scheme was developed to systematically analyze the reviewed articles.

To provide a more transparent and rigorous account of the analytical procedure, the coding process followed a qualitative content analysis approach consisting of two main coding phases, open coding and focused coding (Berelson 1952; Charmaz 2006), followed by a final integrative stage. In the open coding phase, each article in the final dataset was systematically examined and coded on a line-by-line basis using a structured coding scheme. This scheme captured multiple dimensions of the reviewed studies, including bibliographic information, research scope, waste type, geographical context, methodological characteristics, theoretical foundations, and supply chain-related aspects. At this stage, key concepts, research focuses, and process-related elements were identified inductively, allowing recurring themes and patterns across HWSC studies to emerge.

In the focused coding phase, the initial codes were compared, refined, and grouped into higher-order categories following a hybrid analytical logic that combined inductive category development with deductive alignment to established supply chain process frameworks. This process involved aligning emergent themes with predefined supply chain process dimensions (e.g. manufacturing flow management, supplier relationship management, returns management, product development and commercialization, demand management, order fulfillment), as well as consolidating topic–subtopic structures and actor-based categorizations. Inconsistencies across codes were iteratively reviewed and resolved to ensure internal coherence and consistency within the coding structure. In the final stage, the refined categories were integrated into a coherent analytical structure, enabling the synthesis of findings across the reviewed literature. The proposed HWSC framework was derived through the systematic integration of inductively developed categories with established supply chain process structures. Specifically, the emergent themes and categories identified during the coding process were mapped onto core supply chain business processes, enabling the conceptualization of household waste activities within a process-oriented supply chain perspective. Overall, the analytical process can be characterized as abductive, involving an iterative back-and-forth interplay between data-driven insights and theory-informed structuring, whereby emerging interpretations were continuously revisited and refined throughout the analysis (Langley 1999).

To enhance the validity and reliability of the coding process, multiple researchers were involved in the analysis. A subset of the articles was independently coded by two researchers, and the results were compared to ensure consistency. Discrepancies were discussed and resolved through consensus, leading to further refinement of the coding scheme. This iterative

procedure strengthened inter-coder reliability and ensured the robustness and reproducibility of the analysis. The analysis helped to understand the overall framework of the household waste system and enabled the synthesis of diverse research streams into an integrated HWSC perspective.

3. Findings

3.1. Descriptive Results

To gain a deeper understanding of the field, the papers were first evaluated descriptively. To ensure an up-to-date understanding a specific time interval was selected at the beginning of the study. Furthermore, the extant literature focuses on several categories of household waste. Trends in the last five years (2015 to 2025) show that municipal solid waste was the most common type of waste, followed by food waste, waste from electric and electronical equipment (WEEE), and plastic/packaging, medical, hazardous and textile waste (Baybars et al. 2024; Güzel and Kavalcı 2024; Popa et al. 2024).

In terms of research focus, 79% of the papers (390) were empirical. This type of papers helps researchers to identify the current conditions from various point of views. Regarding methodology preferences, 73% (361) quantitative methodology, 15% (72), mixed methods and followed 12% (60), qualitative methodology. In addition, 16% were policy papers (80), allowing countries to exchange views and determine the best practices in the ongoing waste process. 5% of the papers (23) were of the life cycle assessment (LCA) type, allowing the researchers to follow the life-cycle stages of a particular product or service.

The level of coverage varied among the reviewed papers. Approximately equal shares of studies assessed waste management principles at the city (42%) and national (41%) levels, whereas district- and international-level investigations were relatively limited.

Among the 493 studies reviewed, the large majority did not employ a theoretical framework (n = 447), while only 46 studies were theory-informed. Within this group, behavioral theories (primarily the Theory of Planned Behavior and its extensions) were the most frequently applied (n = 20). CE–based frameworks constituted the second largest group (n = 9), followed by utility/choice-based theories (n = 4) and systems-based theories (n = 4). Practice-based approaches (n=2), economic and institutional theories (n=3), and stakeholder/governance theories (n = 2) were used only to a limited extend.

With respect to waste categories, research on relationship structures among SCM actors predominantly focuses on single actors, particularly households, consumers, prosumers, and patients. These studies mainly examine end-user behavioral and characteristic factors related to waste generation, recycling, and environmental satisfaction across food, solid, and medical

waste streams. Dyadic relationships are addressed at the household–stakeholder and household–local authority levels, where household behavior is shaped by regulatory interventions and waste collection policies. At the stakeholder level, pricing strategies are frequently analyzed using game-theoretic approaches. Triadic relationship studies are comparatively rare and primarily explore interactions among producers, retailers, and consumers, focusing on key competencies and collaboration strategies. Studies adopting a network-based perspective remain limited, especially those examining interactions among distributors, resellers, consumers, and public authorities, often within alternative reverse logistics models.

In addition to the descriptive characteristics of the reviewed studies, the analysis also identified the most prominent journals publishing research on household waste and CSCs. The reviewed articles are concentrated in a limited number of journals with a strong focus on sustainability, waste management, and supply chain research. Leading outlets include journals such as *Journal of Cleaner Production*, *Waste Management*, *Sustainability*, *Science of the Total Environment and Resources*, *Conservation & Recycling*. These journals serve as primary publication platforms for interdisciplinary research at the intersection of CE and SCM.

3.2. Thematic Analysis

The thematic analysis assesses the reviewed articles based on their scope within HWSCs. Household waste management has received growing attention across environmental studies, public policy and operations related disciplines (Farooque et al. 2019; McLean and Roggema 2019). The reviewed literature reflects a strong empirical orientation, with a predominant focus on household behavior, policy instruments and waste separation practices. However, engagement with established frameworks remains unclear. When the theory is employed, behavioral models (mainly Theory of Planned Behavior) are most frequently adopted while CE perspectives appear as a secondary research stream. Systems-based, governance-oriented, and supply chain–focused theoretical lenses remain comparatively limited.

SCM literature offers a well-established theoretical foundation for addressing such coordination challenges. Early contributions by Cooper et al. (1997) conceptualized SCM as the integration of business process, supply chain structure and management components. Building on this foundation, Lambert and Cooper (2000) and Lambert and Enz (2017) defined a set of core supply chain business processes including manufacturing flow management (MFM), supplier relationship management (SRM), returns management (RM), product development and commercialization (PDC), demand management (DM), order fulfillment

(OF) and customer relationship management (CRM). This SLR study describes a review of 493 papers, which enabled the researchers to identify the interactions among the actors of HWSC regarding household waste management practices within the framework of Lambert and Enz (2017)'s supply chain model processes. While these SCM frameworks were originally developed for linear, forward-oriented SCs, the reviewed HWSC literature increasingly points to the need for their adaptation to circular and reverse flow contexts. Herein, household waste systems differ fundamentally from traditional supply chains in at least three aspects; i) households act simultaneously as consumers and suppliers of the materials (Du Rietz 2023; Ozdamar and Göçer 2025), ii) waste flows are characterized by high uncertainty in quality and quantity (Nourbakhshsamani et al. 2021), iii) coordination relies heavily on behavioral aspects, institutional incentives and public governance mechanisms (Yu et al. 2022; Saeedi 2024). Operationalizing the adapted SC process perspective in the context of household waste management requires the brief identification of the actors involved and the clarification of their roles within the HWSCs.

HWSC actors include, households, local authorities, service providers, waste collecting companies, waste processing companies and producers. Among the most critical actors in HWSC, households, whom are accepted as end-users in HWSC, are conceptualized in this framework as active suppliers of waste materials, as they determine both the quantity and quality of waste generated through consumption, separation and disposal practices. Respective amount of waste is produced by households. This partner's interaction within HWSCs mostly shapes the general framework.

Local authorities including governmental and non-governmental organizations, semi-governmental institutions which have a power on mostly legislative issues and ability to take initiatives and policy development processes. Rather than directly managing material flows, local authorities shape the institutional environment within which other actors operate. In HWSC framework, service providers have multidimensional meanings according to the relationships between the actors. For example, service providers as wholesalers, retailers, shopping places, catering services or school canteens mostly in contact with the households during various operations. Service providers should therefore be understood as a role-based category rather than a single homogenous actor type. On the other hand, in downstream interactions, waste collecting companies (waste collectors), accepted as a service provider where the triadic operations observed within households, local authority and service providers. Even they are connected numerous actors, they also have connections between commercial and industrial sectors. In addition, waste processing companies represent focal company in HWSC. This actor gathers the waste from households or related partners (e.g.

service providers) in HWSC, including the various processes and afterwards reselling the materials. In this sense, waste processing companies function as transformation and valorization hubs. Another actor, producers, as consumers who demand/use/recycle the waste materials as a raw material in HWSC. Last but not least, incineration facilities in HWSC identifies the process where recycling and reuse options of operations take place. The hierarchy of main themes and sub-themes identified through the coding process is summarized in Table 1.

Table 1. Hierarchical Structure of Main Themes and Sub-Themes in HWSC Studies

Supply Chain Management Process	*Main Theme*	*Sub-Themes*
Manufacturing Flow Management (MFM)	Waste Generation	Consumption patterns, product design, behavioral interventions (nudging, COVID-19 effects)
	Waste Separation	Source separation practices, quality control of waste streams; household preferences
	Waste Collection Operations	Collection system design, operational efficiency, stakeholder coordination; household participation and willingness to pay
Supplier Relationship Management (SRM)	Waste Collection Methods & System Design	Service design, system optimization, barriers in collection systems
	Household Motivation	Behavioral factors, incentives, nudging strategies, social norms; digital engagement tools
	Organization of Waste Handling	Coordination mechanisms, multi-actor platforms
	Waste Separation Practices by Partners	Partner-level sorting practices, operational alignment

Returns Management (RM)	Waste Classification	Sorting accuracy, composition identification
	Re-evaluation of Waste as a Source	Acceptance/rejection decisions, quality thresholds
Product Development and Commercialization (PDC)	Waste-based Product Development	Bio-based products, recycled materials
	Commercialization of waste—based products	Market acceptance, labeling, consumer awareness
Demand Management (DM)	Waste Requirement Estimation	Forecasting, planning, uncertainty
	System Performance & Satisfaction	Service quality, infrastructure effectiveness
	Demand for Waste-Derived Outputs	Recycled products, energy demand
	Demand Uncertainty and Forecasting Challenges	Impact of participation variability; Post-COVID volatility
Order Fulfillment (OF)	Ordering of Secondary Materials	Compost, secondary aggregates
	Ordering Strategies	Flexibility, adaptive strategies, uncertainty management

Table 1 provides a structured overview of how the reviewed studies are organized across supply chain process categories and their corresponding research domains, serving as a bridge between the thematic analysis and the detailed process-based discussion. The interactions among the actors described above are explained in the following part of the study.

3.3. Reconceptualizing Supply Chain Business Processes in HWSCs

3.3.1. Manufacturing Flow Management

Lambert and Enz (2017) define MFM as the coordination of material flows from suppliers to end users in line with observed demand. In HWSCs, this process is reinterpreted through waste-oriented flows, where raw material sourcing is replaced by household waste generation, production and quality control by waste separation and classification, and inventory and

distribution by waste collection and aggregation. The dominant research stream within MFM focuses on household waste generation, examining consumption patterns, product design, and consumer attitudes as key drivers of waste behavior, while also assessing waste management systems, waste reduction opportunities, and material recovery potential for future forecasting purposes (Bocken et al. 2016; Ananda et al. 2024; Baybars et al. 2024; Madden and Florin 2024; Nguyen et al. 2024). Recent studies emphasize the growing influence of behavioral interventions, contextual conditions, and external disruptions, including nudging approaches, societal crises, and COVID-19 related changes in consumption, on household waste generation patterns, adding further volatility to MFM processes (Ananda et al. 2024; Baybars et al. 2024; Popa et al. 2024; Rogowska et al. 2024; UNEP 2024). Herein, waste separation functionally replaces quality control by determining the purity and usability of waste streams, with separation behavior shaped by household preferences and source separation practices (Yu et al. 2022; Popa et al. 2024; Rogowska et al. 2024; Tam and Anh 2024). As waste collection constitutes the final stage of MFM, focusing on collection system design, operational efficiency, and stakeholder coordination, while household participation and willingness to pay reflect the role of policy and governance structures, particularly under health-related and COVID-19 disruptions (Nguyen et al. 2024; Madden and Florin 2024; Rogowska et al. 2024; Popa et al. 2024).

3.3.2. Supplier Relationship Management

SRM in Lambert and Enz's (2017) framework refers to managing interactions and coordination mechanisms among supply chain actors. In HWSCs, SRM differs from contract-based supplier management and is primarily shaped by behavioral compliance, institutional incentives, and public governance mechanisms. Households are conceptualized as suppliers, and SRM processes involve managing relationships among households, service providers, and producers.

The literature identifies several SRM-related categories, including waste collection methods, household motivation for recycling participation, organization of waste handling processes, waste management policy decisions, coordination for waste reduction, and waste separation practices. Studies on waste collection methods focus on service providers' operational perspectives and system design (Farooque et al. 2019; Halldórsson et al. 2019; Madden and Florin 2024; Nguyen et al. 2024), as well as barriers and optimization opportunities within collection systems (Corsini et al. 2017; Bressanelli et al. 2019; Madden and Florin 2024; Nguyen et al. 2024). Trust, service quality, and institutional credibility

significantly influence household–collector relationships and related compliance behaviors (Rogowska et al. 2024; Popa et al. 2024; Tam and Anh 2024).

In addition to waste collection methods, existing research also focuses on household motivation to transfer waste into recycling systems. This household motivation to shaped by environmental transportation practices, behavioral factors, and strategic waste management decisions (Yu et al. 2022; Baybars et al. 2024; Popa et al. 2024). Recent studies emphasize the role of nudging strategies, social norms, and digital engagement tools in enhancing participation and strengthening household–system relationships (Du Rietz 2023; Rogowska et al. 2024; Saeedi 2024).

Beyond household motivation, the literature also emphasizes the organization of waste handling processes across HWSCs. Effective organization of waste handling processes requires coordination among HWSC partners and appropriate treatment methods for different waste types (Bressanelli et al. 2019; Madden and Florin 2024). This coordination increasingly relies on multi-actor platforms and technology-enabled engagement mechanisms (Nguyen et al. 2024; Saeedi 2024). Waste management policy decisions further shape SRM by facilitating the identification of barriers and system inefficiencies when households are recognized as suppliers (Popa et al. 2024; Rogowska et al. 2024). Regulatory clarity, enforcement credibility, and transparency directly affect household compliance and inter-actor trust, while multi-stakeholder involvement supports more effective policy design (Yu et al. 2022; UNEP 2024).

3.3.3. Returns Management

RM in traditional supply chains focuses on reverse logistics and product returns (Lambert and Enz 2017). In HWSCs, however, RM plays a limited and conditional role, as households do not return products within contractual exchange relationships. Consequently, most reverse material flows are addressed within MFM and SRM processes. RM in HWSCs becomes relevant primarily under CE conditions, where secondary materials derived from household waste are evaluated, accepted, or rejected by downstream actors. RM-related activities include waste classification for acceptance decisions, re-evaluation of waste-derived materials as raw inputs, and transformation of rejected materials into usable secondary resources.

Within these processes, waste classification plays a central role in identifying waste composition and determining appropriate downstream processing options (Madden and Florin 2024; Nguyen et al. 2024). This becomes especially important when waste streams are heterogeneous, as classification errors can lead to rejection or re-routing (Yu et al. 2022; Madden and Florin 2024). Re-evaluation of waste as a raw material supports sustainable

consumer behavior and reuse strategies (Geissdoerfer et al. 2017; Tong et al. 2018; Kasulaitis et al. 2019). Recent studies emphasize that these processes are influenced by household participation levels, source separation accuracy, and quality thresholds imposed by downstream users (Nourbakhshsamani et al. 2022; Popa et al. 2024; Rogowska et al. 2024).

From an operational perspective, the transformation of waste into secondary raw materials is shaped by broader institutional and market conditions. Transforming waste into secondary raw materials requires compliance with regulatory frameworks and responsiveness to market demand. Post-COVID operational conditions further constrain RM processes, reinforcing their conditional role within HWSCs (Mavlutova et al. 2023; Ozdamar and Göçer 2025)

3.3.4. Product Development and Commercialization

PDC represents the innovation dimension of SCM (Lambert and Enz 2017). In HWSCs, PDC focuses on converting processed waste into new products and value propositions, primarily led by waste processing companies. The literature addresses policy frameworks that support product development from waste, emphasizing the role of waste treatment policies in guiding processing decisions (Bocken et al. 2016; Geissdoerfer et al. 2017; Kirchherr et al. 2017). Recent studies highlight a growing focus on bio-based products, recycled construction materials, secondary plastics, and compost-derived outputs aligned with CE objectives (Tong et al. 2018; Kasulaitis et al. 2019; Mavlutova et al. 2023).

Building on these developments, research also highlights the commercialization challenges associated with waste-derived products. Developing new products from waste enables economic value creation and supports the evolution of recycling practices (Tong et al. 2018; McLean and Roggema 2019). Effective commercialization depends not only on technical recovery processes but also on environmental performance assessments and long-term recovery system design (Batista et al. 2018; Bressannelli et al. 2019). Demand-side engagement mechanisms, such as labeling strategies and consumer awareness initiatives, play an increasingly important role in overcoming resistance to recycled products (Du Rietz 2023; Madden and Florin 2024; Saeedi 2024).

3.3.5. Demand Management

DM traditionally balances supply and demand within a supply chain (Lambert and Enz 2017). In HWSCs, demand is driven not by primary consumption needs but by the utilization potential of waste-derived materials, products, and energy. DM processes involve households, local authorities, waste collectors, processors, and producers.

Within this context, the literature identifies several key research areas related to DM in HWSCs, Key research areas include waste requirement estimation, satisfaction with waste supply services, effectiveness of waste infrastructure, demand for waste-derived products, and forecasting demand for waste-based energy. Waste requirement estimation supports strategic planning by forecasting material availability and storage needs (Madden and Florin 2024; Nguyen et al. 2024; Kostha et al 2024). However, uncertainty in household participation and source separation accuracy significantly affects forecasting accuracy, particularly under post-COVID conditions (Nourbakhshsamani et al. 2022; Yu et al. 2022).

Beyond forecasting considerations, demand-related outcomes are also shaped by service quality and system performance. Satisfaction with waste supply services influences overall system performance, as inconsistent waste quality reduces downstream demand for secondary materials (Corsini et al. 2017; Popa et al. 2024; Rogowska et al. 2024). Assessing infrastructure effectiveness and coordination among actors further supports strategic decision-making (Bressanelli et al. 2019; Farooque et al. 2019; Nguyen et al. 2024). Demand for recycled products and waste-derived energy is shaped by consumer acceptance, policy incentives, energy prices, and regulatory targets (Du Rietz 2023; Mavlutova et al. 2023; Madden and Florin 2024).

3.3.6. Order Fulfilment

OF refers to network design and order execution processes in SCM (Lambert and Enz 2017). In HWSCs, OF focuses on producers' orders for decomposed and processed waste materials. These processes are primarily conducted by waste processing companies and producers.

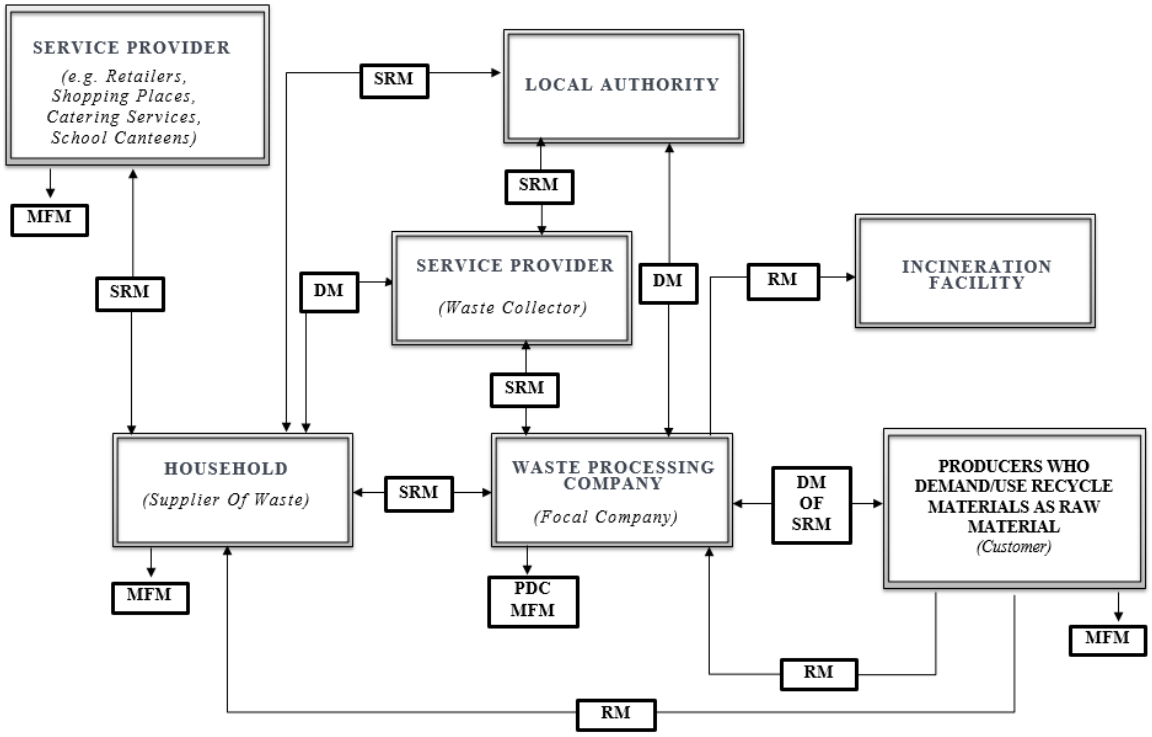
Within this framework, the literature emphasizes the role of ordering waste-derived materials in supporting sustainable consumption and circular CE objectives (Kasulaitis et al. 2019). Empirical studies document orders for compost, recycled polymers, and secondary aggregates derived from household waste streams (Nourbakhshsamani et al. 2022; Mavlutova et al. 2023; Madden and Florin 2024). However, such orders are contingent on material quality, regulatory compliance, and supply reliability.

Given these conditions, research suggests that effective ordering strategies in HWSCs require adaptive and flexible approaches rather than fixed replenishment rules. This need arises from uncertainty in waste availability and fluctuating demand for secondary materials (Koshta et al. 2024; Madden and Florin 2024; Ozdamar and Göçer 2025).

3.3.7. Conceptual Model

The conceptual HWSC model illustrates the interactions and interdependencies among the main actors. The model encompasses households as waste generators, waste collectors and service providers responsible for collection and logistics, waste processing companies engaged in treatment and recovery processes, incineration facilities involved in final disposal and energy recovery, and local authorities managing the regulation and coordination of the system (see Figure 3). The model highlights how traditional forward-oriented supply chain processes are redistributed across actors under circular and reverse-flow conditions, with households positioned as upstream suppliers of waste, waste processing companies acting as focal coordinators, incineration facilities serving as terminal nodes for non-recyclable fractions and energy recovery, and local authorities shaping governance and relational dynamics.

Figure 3 synthesizes the findings of the SLR by visually integrating the adapted SC business processes and actor roles discussed in the study. Rather than introducing new mechanisms, the figure operationalizes the conceptual distinctions established across MFM, SRM, RM, PDC, DM, and OF by mapping them onto the HWSC structure, including downstream treatment and final disposal routes associated with incineration facilities.



MFM: Manufacturing Flow Management; RM: Returns Management; SRM: Supplier Relationship Management;

OF: Order Fulfilment; PDC: Product Development and Commercialization; DM: Demand Management

Figure 3. Process-Oriented HWSC Management Framework
Source: Created by the authors

By explicitly linking actors to specific process domains, the figure clarifies where each supply chain process is activated, interrelates with others, or remains conditional, particularly in the case of RM, which connects material recovery activities with both recycling-oriented processes and incineration-based disposal options. Overall, the conceptual model serves as an integrative representation of the HWSC, enabling a coherent interpretation of process interactions and actor interdependencies.

4. Conclusion and Discussion

The findings of this study provide a structured, process-oriented perspective on HWSCs as a critical enabler of the CE. From a CE perspective, the analyzed studies address key circularity mechanisms, including waste prevention, source separation, material recovery, reuse, recycling, and the reintegration of secondary materials into production systems, which extend material lifecycles and reduce reliance on virgin resources (Madden and Florin 2024; Nourbakhshsamani et al. 2022).

Moreover, the analysis shows that household waste circularity does not emerge from isolated actors, but from coordinated business processes involving households, service providers, waste collectors, waste processing companies, producers, and local authorities. While much of the literature focuses on single actors or limited relational settings, increasing attention is paid to behavioral coordination, information flows, and governance mechanisms (Farooque et al. 2019; Ozdamar and Göçer 2025; Popa et al. 2024; Rogowska et al. 2024; Yu et al. 2022). This underlines that circularity in household waste systems is fundamentally a supply chain coordination challenge rather than a technological one.

By mapping household waste activities to adapted supply chain business processes (MFM, SRM, RM, PDC, DM and OF), this study illustrates how traditional linear supply chain logics are transformed under CE conditions. MFM is reinterpreted through waste generation, separation, and collection processes that are strongly influenced by household behavior, policy instruments, and contextual disruptions such as COVID-19 conditions (Ananda et al. 2024; Rogowska et al. 2024; Tam and Anh 2024). Similarly, SRM shifts from contract-based arrangements toward behavioral compliance, social norms, and incentive-based coordination mechanisms (Popa et al. 2024; Rogowska et al. 2024; Saeedi 2024; Tam and Anh 2024).

RM emerges as a conditional and selective process in circular HWSCs, activated primarily when secondary materials are evaluated for acceptance or rejection by downstream users. Recent studies highlight that quality thresholds, regulatory compliance, and market demand determine whether waste-derived materials can re-enter production systems as usable inputs (Tong et al. 2018; Kasulaitis et al. 2019; Mavlutova et al. 2023). This finding reinforces that not all reverse flows in household waste systems constitute returns management, but only those linked to circular reintegration decisions.

PDC processes demonstrate how circular value is captured from household waste through the production of compost, recycled polymers, secondary construction materials, and textile-derived products (Nourbakhshsamani et al. 2022; Mavlutova et al. 2023; Madden and Florin 2024). The reviewed studies further indicate that successful commercialization increasingly depends on policy support, consumer acceptance, and incentive-based engagement mechanisms such as deposit–refund schemes and loyalty programs (Du Rietz 2023; Saeedi 2024).

DM and OF reflect the market-facing dimension of CSCs, where demand for waste-derived products and energy is shaped by supply reliability, waste quality, and institutional conditions. Recent findings show that uncertainty in household participation, post-pandemic disruptions, and governance capacity significantly affect demand forecasting and ordering strategies for secondary materials (Yu et al. 2022; Ozdamar aand Göçer 2025).

Overall, the findings demonstrate that HWSCs play a foundational role in enabling CSCs by operationalizing CE principles through coordinated supply chain processes. By adopting a supply chain process perspective, this study contributes to CE research by clarifying how circularity can be systematically embedded within household waste management systems rather than treated as an isolated sustainability objective.

4.1. Implications

Despite the expanding literature on CE, the integration of circularity into SCM remains limited in the context of household waste. Existing studies on household waste largely emphasize behavioral or policy dimensions, while the SC processes through which circularity is enabled, coordinated, or disrupted are rarely examined using SCM theory. As a result, circularity is often treated as an assumed outcome of recycling activities rather than as a SC performance issue.

Household waste constitutes a critical upstream node in CSCs, where materials either remain within local recovery loops or enter national and international secondary material markets. However, the circulation of household waste across supply chains does not necessarily ensure circular outcomes, raising important questions about where, how, and for whom circular value is created. This study contributes to the literature by bridging SCM and CE through a process-based HWSC framework. By adapting the Lambert and Enz (2017) supply chain business processes to the household waste context, the study enables a structured examination of circularity across supply chain processes rather than isolated waste activities. In doing so, it provides a theoretical foundation for critically assessing CSCs, particularly with respect to actor coordination, material flows, and the distinction between local circularity and global redistribution of waste.

4.2. Avenues for Further Research

Building on the findings of this SLR and the adapted supply chain process framework, future research should conceptualize HWSCs as integral components of CSCs rather than as isolated waste management systems. Although recent studies increasingly examine household behavior, waste separation, and recycling intentions, households are still predominantly treated as passive waste generators. Future research should reposition households as strategic upstream actors whose decisions directly influence material quality, supply reliability, and downstream recovery performance, particularly across heterogeneous socioeconomic, post-conflict, and post-pandemic contexts (Yu et al. 2022; Popa et al. 2024; Rogowska et al. 2024).

Beyond the role of households, the findings further highlight the importance of actor-role differentiation and inter-actor coordination in enabling circularity within HWSCs. While existing studies often focus on individual actors, limited attention has been paid to how responsibilities, decision rights, and information flows are coordinated among households, service providers, collectors, processors, producers, and public authorities. Adopting a CSC perspective would allow future research to systematically map these interactions and assess how governance structures, trust, and institutional credibility shape coordination outcomes, particularly in developing and transition economies (Farooque et al. 2019; Popa et al. 2024; Rogowska et al. 2024).

Closely linked to coordination challenges is the role of household consumption habits in shaping circular outcomes within HWSCs. Although increasing attention has been paid to consumer intentions, awareness, and attitudes toward sorting and recycling, there remains a clear need for interdisciplinary research that links household consumption choices with upstream waste generation and downstream circular value creation. Integrating behavioral science, operations management, and CE perspectives would enable a more comprehensive understanding of how consumption patterns, product choices, and usage behaviors influence waste quantities, material quality, and overall HWSC performance (Tam and Anh 2024). Closely related to this stream is the role of product characteristics within household waste flows. Existing research on packaging, textiles, e-waste, and construction-related household waste suggests that material properties, product design, and life-cycle characteristics strongly shape recovery, reuse, and recycling potential. Future studies could therefore link product design and material selection decisions with downstream CSC performance and recovery efficiency (Güzel and Kavalcı 2024; Mavlutova et al. 2024).

In conclusion, urban and city-level planning further represents a critical interface between infrastructure design, technological development, and CSC performance. Empirical studies highlight the importance of spatial planning, collection system design, and infrastructure adequacy in enabling circular material flows within HWSCs. Future research could apply logistics and process-oriented models to evaluate trade-offs among transport distances, vehicle configurations, cost efficiency, and environmental impacts in circular household waste systems (Madden and Florin 2024; Nguyen et al. 2024). At the same time, alternative supply chain designs for household waste systems merit closer examination. Different HWSC configurations may vary substantially in their ability to support circularity, resilience, and adaptability under uncertainty and disruption, including post-COVID-19 conditions (Tran et al. 2019; Ananda et al. 2024). In this context, technological developments offer additional opportunities to enhance transparency and coordination across CSCs. Digital engagement

tools, social media analytics, blockchain-based incentive mechanisms, and data-driven monitoring systems can support information sharing, performance tracking, and adaptive coordination among CSC actors, thereby strengthening the integration of HWSCs into broader CE systems (Nourbakhshsamani et al. 2022; Saeedi 2024).

4.3. Limitations

Despite its contributions, this study is subject to several limitations that should be acknowledged. First, the literature search was limited to the Web of Science database. Although this ensures the inclusion of high-quality peer-reviewed publications, it may have led to the exclusion of relevant studies indexed in other databases such as Scopus or Google Scholar. In a similar point of view, the review only included articles published in English, which may introduce language bias and limit the representation of region-specific studies published in other languages.

Furthermore, the analysis was restricted to the period between 2015 and 2025. While this timeframe captures the most recent developments in CE and household waste research, earlier foundational contributions may not be fully reflected. In addition, the study relies on a qualitative content analysis approach. Although coding reliability was strengthened through the involvement of multiple researchers and iterative validation procedures, the interpretation and categorization of the studies may still involve a degree of subjectivity. Future research could address these limitations by expanding database coverage, incorporating multilingual sources and complementing qualitative approaches with bibliometric or other quantitative methods to enhance robustness and generalizability.

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