

## Enhancing Secondhand Market Dynamics through Circular Economy Principles and Technological Advancements: A Bibliometric Analysis

Adilah Asma Amanina\*

<sup>1</sup>Department of Digital Business, Faculty of Economics, Universitas Negeri Surabaya

Jalan Ketintang, Surabaya 60231, Indonesia

[adilah.21032@mhs.unesa.ac.id](mailto:adilah.21032@mhs.unesa.ac.id)

### Abstract

Given the increasing focus on sustainability and resource efficiency, the interest in the secondhand market as a vital segment of the circular economy has also risen tremendously. This paper offers a bibliometric analysis of the changing features of the secondhand market that focus on circular economy aspects and technological development that transform this market. In the scope of this review, we strive to establish how the integration of circular strategies such as reuse, recycling, and product life extension as well as advances in technology have improved market efficiency, accessibility experiences for consumers, and efficiency on nature. Important conclusions emphasize the role of digital platforms, blockchain, artificial intelligence, and the Internet of Things in improving the efficiency of product tracking, trust, and transaction transparency in the secondhand market. The knowledge acquired proposes ways in which some of the stakeholders can implement technological solutions to the circular economy and enhance the concept of circularity in the economy.

**Keywords:** *Secondhand Market; Circular Economy; Technological Advancement; Bibliometric Analysis; Sustainability*

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\*Corresponding author

Email: [adilah.21032@mhs.unesa.ac.id](mailto:adilah.21032@mhs.unesa.ac.id)

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### **Abstrak**

*Dengan meningkatnya fokus keberlanjutan dan efisiensi sumber daya, minat terhadap pasar barang bekas sebagai segmen penting dalam ekonomi sirkular juga meningkat pesat. Penelitian ini membahas analisis bibliometrik tentang perubahan fitur pasar barang bekas yang berfokus pada aspek ekonomi sirkular dan perkembangan teknologi yang telah mengubah pasar ini. Dalam ruang lingkup tinjauan ini, peneliti berusaha untuk menetapkan bagaimana integrasi strategi sirkular seperti penggunaan ulang, daur ulang, dan perpanjangan masa pakai produk serta kemajuan teknologi telah meningkatkan efisiensi pasar, pengalaman aksesibilitas bagi konsumen, dan efisiensi pada alam. Penelitian ini menekankan peran platform digital, blockchain, kecerdasan buatan, dan Internet of Things dalam meningkatkan efisiensi pelacakan produk, kepercayaan, dan transparansi transaksi di pasar barang bekas. Pengetahuan yang diperoleh mengusulkan cara-cara yang dapat digunakan oleh beberapa pemangku kepentingan untuk menerapkan solusi teknologi untuk ekonomi sirkular dan meningkatkan konsep sirkularitas dalam ekonomi.*

**Kata kunci:** Pasar Barang Bekas; Ekonomi Sirkular; Kemajuan Teknologi; Analisis Bibliometrik; Keberlanjutan

### **INTRODUCTION**

The secondhand market has become an essential component of the circular economy, reflecting the growing global emphasis on sustainability and resource efficiency. As a platform for reusing and recycling products, the secondhand market contributes to reducing waste and extending product life cycles, thereby aligning with circular economy principles (Nobre & Tavares, 2017). This approach not only mitigates the environmental impact of production and consumption but also creates economic opportunities by unlocking the value of previously discarded goods. Such shifts in market dynamics highlight the need to understand how these systems are evolving in response to technological and strategic innovations (Araujo Galvão et al., 2018).

In recent years, the secondhand market has witnessed exponential growth, driven by consumer shifts toward conscious consumption and the increasing availability of digital platforms that facilitate peer-to-peer exchanges. Platforms like eBay, Poshmark, and Facebook Marketplace exemplify how technological tools have democratized access to resale markets, enabling individual sellers to monetize unused goods while promoting a culture of reuse (Zamani et al., 2017). Notably, Gen Z and

millennial consumers are at the forefront of this trend, often driven by environmental motivations and the appeal of unique, affordable products (Diddi & Niehm, 2017). This generational shift underscores the evolving values in consumer behavior, where environmental responsibility and digital savviness go hand-in-hand.

Technological advancements are increasingly playing a transformative role in reshaping the secondhand market. Digital platforms and blockchain technology are streamlining operations by enhancing transaction transparency and trust between buyers and sellers (Chi et al., 2023). These tools are essential for mitigating common concerns in secondhand transactions, such as product authenticity and quality assurance. For instance, blockchain's immutable ledger enables the secure documentation of product histories, ensuring provenance and enabling better decision-making for buyers (Saber et al., 2019). Such traceability is particularly relevant in sectors like electronics and fashion, where product quality and ethical sourcing are major concerns.

Similarly, artificial intelligence (AI) and the Internet of Things (IoT) are being deployed to improve product tracking and automate processes, further improving market efficiency. AI algorithms can predict supply and demand trends, optimize pricing, and personalize recommendations, making platforms more intuitive and user-centric (Gupta et al., 2020). For example, recommerce companies like thredUP use AI-driven sorting systems to evaluate the condition and category of secondhand clothing, thereby enhancing scalability and reducing operational costs. On the other hand, IoT sensors embedded in durable goods like appliances or furniture can monitor usage data, aiding in predictive maintenance and certifying whether products are suitable for resale or recycling (Pagoropoulos et al., 2017). These technologies enable businesses and consumers to engage more effectively in circular practices, ensuring that resources are utilized optimally and waste generation is minimized (Alonso-Muñoz et al., 2023).

In addition to marketplace dynamics, environmental policies and regulations are also influencing the adoption of circular economy strategies in secondhand markets. Governments across Europe, for instance, are promoting Extended Producer Responsibility (EPR) schemes, which require manufacturers to take back end-of-life products for reuse, refurbishment, or recycling (OECD, 2020). Such policies are pushing brands to establish take-back programs and resale channels, which further institutionalize secondhand markets. Notably, IKEA and Patagonia have implemented initiatives to buy back used products, refurbish them, and resell them through branded secondhand sections (Ellen MacArthur Foundation, 2021).

These corporate practices not only extend product life but also foster customer loyalty and environmental credibility.

Research underscores the growing academic interest in the integration of circular economy strategies with technological innovations. Bibliometric analyses of these intersections reveal key trends, such as the increasing application of IoT in resource tracking and the use of AI to predict market behaviors, as critical areas driving the secondhand market forward (Araujo Galvão et al., 2018). These trends also reveal regional disparities in research focus, with European countries leading in policy-driven research, while Asian and American literature focuses more on consumer behavior and digital platform development (Nobre & Tavares, 2017; Chi et al., 2023).

Moreover, blockchain technology has been identified as a significant enabler for enhancing trust, particularly in verifying the provenance and quality of secondhand goods. For luxury markets—where counterfeiting is rampant—blockchain provides a digital certificate of authenticity that follows the product from the original owner to subsequent users (Saberri et al., 2019). Startups like Arianee are leveraging blockchain for fashion authentication, thereby increasing customer confidence in preloved luxury goods.

Despite these advancements, challenges remain. A significant barrier to the growth of the secondhand market is the lack of standardization in quality control and valuation metrics. Unlike new products, secondhand goods vary in wear and condition, making it difficult to assess fair pricing and warranty provisions (Wilhelm et al., 2021). Additionally, digital platforms must grapple with data privacy and security issues, especially when implementing AI or blockchain-based systems. The cost of integrating advanced technologies can also be prohibitive for small-scale vendors or platforms operating in developing economies (De Angelis et al., 2018). Therefore, scalable, inclusive solutions must be developed to ensure that the benefits of circularity are equitably distributed.

Another consideration is the rebound effect, whereby increased efficiency in secondhand transactions may encourage overconsumption. Some scholars argue that making products too easy to resell or replace could undermine the sustainability narrative, shifting the focus from long-term use to short-term trading (Zink & Geyer, 2017). Hence, promoting responsible consumption habits must go hand-in-hand with enabling circular market infrastructure.

This paper contributes to the growing body of knowledge by presenting a bibliometric analysis of the secondhand market through the lens of circular economy principles and technological advancements. By examining existing research, it identifies strategic opportunities for stakeholders to leverage technology in fostering circular practices. Notably, it emphasizes the role of integrated digital ecosystems—where AI, blockchain, and IoT converge—to create intelligent, transparent, and sustainable secondhand markets.

Ultimately, this study aims to guide both academics and practitioners in their efforts to enhance the secondhand market's contribution to sustainability and economic resilience. Such insights are critical in advancing the global transition toward a more sustainable, circular economic model. Future studies could expand this research by incorporating empirical data from platform case studies, consumer ethnographies, or policy implementation outcomes to validate the findings of bibliometric mapping. Interdisciplinary approaches—spanning economics, technology, behavioral science, and environmental studies—are essential for designing secondhand systems that are both profitable and planet-friendly.

## **Secondhand Markets within the Circular Economy Framework**

The secondhand market forms a critical component of the circular economy paradigm, particularly in facilitating reuse, life cycle extension, and waste reduction. According to the Ellen MacArthur Foundation (2021), circular business models encourage practices that shift the economy from a linear take-make-waste system to a regenerative one that minimizes environmental impact and maximizes product utility. In this context, secondhand trading—whether through recommerce platforms or community-based exchanges—supports circularity by extending the life of goods and reducing demand for virgin materials.

Araujo Galvão et al. (2018) emphasized that circular economy initiatives, including secondhand exchanges, face several barriers, such as lack of consumer trust, inefficient logistics, and limited institutional support. These structural barriers can undermine the scaling of secondhand operations, especially in regions with inadequate regulatory or technological infrastructure.

Moreover, De Angelis, Howard, and Miemczyk (2018) introduced the notion of a *circular supply chain*, whereby upstream and downstream activities, including post-consumer product handling, are aligned to support

reuse and recycling. Secondhand markets are thus positioned as crucial nodes within these circular supply chains, often depending on partnerships with logistics providers, recyclers, or refurbishment centers.

However, while the environmental benefits of secondhand consumption are evident, some researchers warn of *rebound effects*—where increased efficiency leads to increased consumption (Zink & Geyer, 2017). In the secondhand context, easy access to preloved goods may encourage impulse buying or rapid disposal, which paradoxically undermines sustainability goals.

### **Consumer Behavior and Social Norms**

Consumer attitudes and behavioral patterns play a central role in the adoption and normalization of secondhand consumption. Diddi and Niehm (2017) explored how personal and social norms influence consumers' intention to engage in sustainable apparel consumption. Their study revealed that moral obligations and perceived social expectations are strong predictors of participation in secondhand or ethical consumption practices. These insights underscore the importance of educational campaigns and community initiatives in promoting a circular consumption culture.

Wilhelm, Schlömer, and Maurer (2021) extended this by examining consumer participation in recommerce—platform-based secondhand transactions that often mimic traditional retail. They found that motivations to participate range from economic benefits and environmental values to novelty-seeking. However, concerns about product hygiene, quality, and convenience remain prevalent, which suggests the need for systems that ensure reliability and trust. Zamani et al. (2017) also demonstrated the complexity of secondhand fashion through a life cycle assessment (LCA) approach. Their analysis highlighted hotspots in clothing reuse—such as transportation emissions and sorting inefficiencies—that challenge the blanket assumption that all secondhand exchanges are environmentally superior. This complexity demands critical evaluation of platform operations and consumer behavior at scale.

### **Digital Technologies as Enablers of Circularity**

One of the most prominent themes in recent literature is the enabling role of digital technologies—particularly blockchain, AI, and IoT—in optimizing secondhand market systems. These technologies

facilitate traceability, predictive analytics, and transaction security, all of which address long-standing barriers in secondhand markets.

Chi et al. (2023) reviewed how digital tools are being leveraged to drive CE innovation. Their findings indicated that blockchain technology, by providing a transparent, immutable ledger, enhances buyer trust in product authenticity and condition. This is especially valuable in markets like fashion or electronics, where counterfeit risks or performance degradation are common concerns.

Complementing this, Saberi et al. (2019) analyzed the integration of blockchain in sustainable supply chain management, noting its ability to document ownership history, certification, and material origin. In secondhand systems, such traceability could revolutionize product provenance tracking, thereby legitimizing resale and building consumer confidence.

Meanwhile, AI and IoT are driving automation and personalization. Gupta et al. (2020) discussed how AI can optimize pricing, categorization, and predictive analytics in the retail sector, including recommerce platforms. For instance, AI-powered systems can automate sorting of used goods, predict buyer preferences, or flag high-demand items—thereby improving operational efficiency and user satisfaction.

Pagoropoulos, Pigosso, and McAlloone (2017) further emphasized that IoT plays a critical role in product lifecycle data collection, such as usage patterns or maintenance history. These data points can inform resale valuations, warranty offerings, or refurbishment strategies—making secondhand platforms more competitive with traditional retailers.

However, these digital transformations also raise privacy, security, and cost concerns, particularly for small enterprises or users in emerging economies (De Angelis et al., 2018). Therefore, the inclusive and ethical deployment of digital infrastructure remains a key research and policy agenda.

### **Policy and Institutional Dynamics**

Regulatory frameworks are pivotal in shaping the scalability and sustainability of secondhand markets. The OECD (2020) highlighted the role of *Extended Producer Responsibility (EPR)* schemes, which obligate producers to manage post-consumer waste. These policies create incentives for producers to design durable goods and establish formal channels for take-back and resale. In practice, companies such as IKEA and H&M have launched buy-back and resale programs under EPR pressure or voluntary sustainability commitments (Ellen MacArthur

Foundation, 2021). These programs often rely on digital platforms to process, assess, and resell used items, demonstrating the symbiotic relationship between policy mandates and technological implementation.

Alonso-Muñoz et al. (2023), though focused on tourism, offered a valuable cross-sectoral lesson in how sustainability must be embedded institutionally. Their review called for integrated, long-term strategies rather than fragmented, one-off sustainability initiatives. For the secondhand sector, this insight suggests the importance of institutionalizing circular practices through curriculum, urban planning, and public-private partnerships.

### **Emerging Research Directions**

While foundational literature outlines the mechanics of circular secondhand markets, emerging studies are beginning to address systemic impacts and global disparities. Nobre and Tavares (2017) performed a bibliometric review identifying an uptick in publications addressing IoT and big data applications in CE but noted a geographical bias in research output, with most studies focused on developed economies. This points to a gap in understanding how secondhand technologies and practices function in the Global South.

Moreover, as Chi et al. (2023) and Wilhelm et al. (2021) argue, there is a growing need to evaluate behavioral-economic trade-offs in secondhand systems. For instance, while digital platforms increase access, they may also encourage overconsumption, leading to a paradoxical “fast-secondhand” economy.

### **METHODS**

This study employs a bibliometric analysis approach to examine the scientific landscape of secondhand market dynamics through circular economy and technological advancement perspectives. “Biblioshiny”, an integrated package within the Bibliometrix R application, is the primary instrument for scientific mapping and bibliometric analysis. The author then uses string "secondhand market" OR "second-hand market" OR "used goods market" OR "preloved market" AND "circular economy" OR "circular business" OR "sustainability" AND "technology" OR "digital platform" OR "technological advancement." We found 378 documents to generate the data.

### **RESULT AND DISCUSSION**

### Bibliometric Thematic Map

In the analysis presented in Figure 1 using Biblioshiny, several categories are available to help interpret and assess research findings. Among these is a thematic map that is divided into four quadrants, namely Niche Themes, Emerging or Declining Themes, Motor Themes, and Basic Themes.

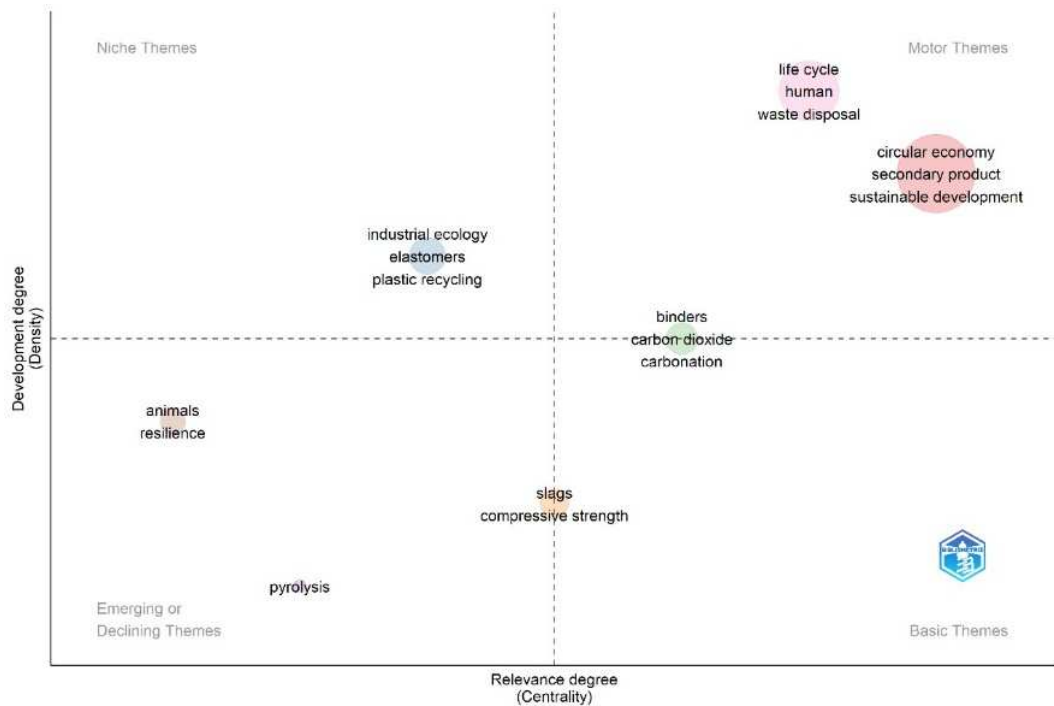


Figure 1. Bibliometric Thematic Map

This theme map illustrates a strong focus on the circular economy, lifecycle analysis, and sustainable development as central and mature areas of research and practice. The field is well-defined by motor themes in the upper-right quadrant, emphasizing the importance of integrating sustainable practices throughout product lifecycles and waste management.

Additionally, specialized areas like industrial ecology and plastic recycling show depth but are more niche, potentially indicating specific applications in industries that need further linkage to the main sustainability field. Basic themes related to materials and carbon management reflect essential, underdeveloped areas crucial for progress in sustainable construction and carbon capture. Emerging themes such as resilience and pyrolysis may signal potential growth in understanding environmental impacts and waste conversion technologies but currently have limited centrality. This diagram highlights that the field is mature and concentrated on integrating circular economy principles but still has room to grow in

areas like material science, carbon management, and emerging conversion technologies.

### Bibliometric Thematic Evolution



Figure 2. Bibliometric thematic evolution

In Figure 2 illustrates the evolution of key research themes or focus areas from 2017–2022 to 2023–2024. The Sankey diagram visualizes the flow and transition of topics, highlighting shifts in emphasis over time. In the earlier period (2017–2022), the primary themes included "circular," "assessment," "by-products," and "slag." These topics evolved into new or refined focus areas in 2023–2024, such as "by-products," "secondary," "circular," "construction," and "food."

The diagram shows that the theme of "circular" remains consistent across both periods, indicating sustained interest in circular economy principles. The topic of "by-products" also persists but gains more prominence, reflecting an increased focus on utilizing industrial by-products. The theme of "slag" transitions into broader applications like "construction" and "food," suggesting diversification in its use. Additionally, new themes like "secondary" emerge, potentially representing a growing interest in secondary materials or processes.

This visualization underscores the dynamic nature of research priorities, with some themes maintaining relevance while others adapt or shift toward emerging applications. It highlights the increasing emphasis on sustainability, resource efficiency, and innovative applications in various sectors.

## CONCLUSION

Based on the results of the analysis conducted on the thematic map and thematic evolution, it can be concluded that these two bibliometric tools provide valuable insights into research trends and developments in sustainability, circular economy, and by-product management. Thematic maps on Biblioshiny effectively group related topics, offering a clear view of central, niche, emerging, and basic themes within the research field. This helps identify the maturity and importance of specific topics, such as the strong focus on circular economy and lifecycle analysis.

Additionally, thematic evolution visualizations illustrate how research priorities shift over time. For instance, the persistence of "circular" themes highlights sustained interest in circular economy principles, while the emergence of "secondary," "construction," and "food" reflects evolving applications of by-product utilization. These tools not only help track changes in focus but also evaluate the success and direction of research strategies, enabling researchers to identify gaps and opportunities for future studies.

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